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Mechanical and Electrical Engineer

DECEMBER, 1951

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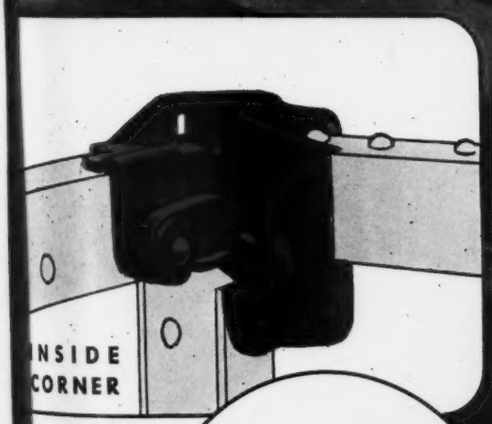

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DECEMBER, 1951

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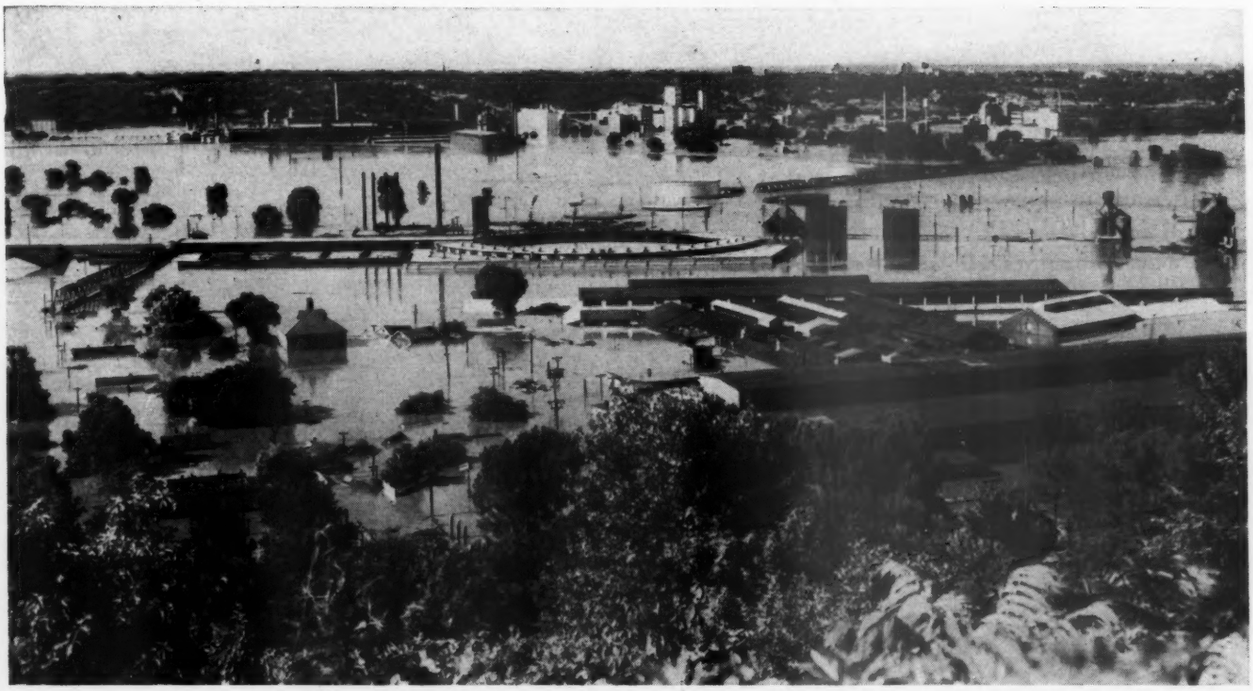


The situation at the Argentine roundhouse on the afternoon of July 14

Restoring Flood-Damaged Equipment*

Approximately 5,500 freight cars, 21 steam locomotives and 51 diesel locomotive units were involved in the July flood at Kansas City (Argentine), Kan., the Atchison, Topeka & Santa Fe restored this equipment to service in a little over a month. The diesel units were reconditioned in Santa Fe system shops in 17 working days.

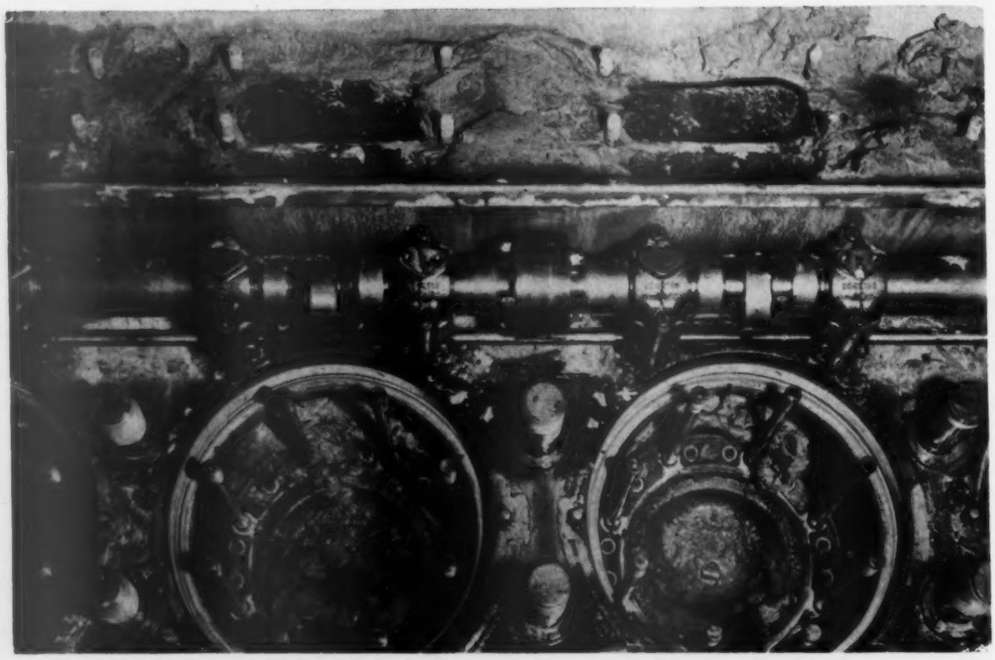
A flood similar to that of July 13, 1951, was experienced on the Santa Fe in 1903 when the Kansas or Kaw river overflowed its banks and discharged an estimated 262,000 cu ft. of water per second downstream, as compared with 500,000 cu. ft. in the latest catastrophe. The maximum depth of water last July was about 22 ft. in the Argentine enginehouse and 26 ft. on the car repair tracks.

The railroad was advised that protective dikes would hold and therefore cars and locomotives were not moved out of that vicinity, although as many locomotives as possible and some wrecker equipment were placed on the hump—just in case. When the flood reached its peak, only about 700 ft. of the crest of the hump remained clear of water.

Another precaution taken by the Santa Fe was to remove electric motors from shop machines at Argentine and place them on top of steam locomotive tenders for protection, with the thought that water would not get that high and the motors would be safe. But when the

* This article is based on information supplied by John Morris, general manager, mechanical, Atchison, Topeka & Santa Fe, in addressing the annual meeting of the Locomotive Maintenance Officers' Association at Chicago on September 19. Facts about the drying out of electrical equipment were presented by L. L. Luthey, general supervisor of diesel engines, at the same meeting.

These diesel locomotives were completely submerged



Mud penetrated to the innermost recesses of the diesel engines and electrical generators and motors

The Argentine roundhouse and turntable after the water had receded. Mud is four feet deep at the back ends of the stalls

water reached maximum depth in the enginehouse it covered the locomotive tenders and these motors were rendered inoperative. At one point, five or six steam locomotives were placed on a Santa Fe bridge to help hold it down, a procedure which worked well in the 1903 flood, but in this instance one of the bridge spans failed and three of the locomotives were lost.

In addition to the affected motive power, 5,500 empty and loaded freight cars were wholly or partially submerged for six days. About 650 of these were derailed; many empty car bodies floated away and some came to rest on top of other equipment. Attendant wrecking and reconditioning is neither easily imagined nor described.

How debris and silt up to four feet deep were removed from Santa Fe facilities at Argentine after the water receded is a story in itself. This task occupied the full efforts of about 700 men, fully supplied with bulldozers, high-lifts, trucks and other mechanical equipment and working around the clock for nearly three weeks. No authentic estimate is available of how many thousand truck loads of mud were hauled away.

About the first requirement was to get compressed air and water for cleaning and testing purposes. In the emergency, electric power was supplied from an outside source to operate portable motor-driven equipment and lights. Gas-engine-driven water pumps were utilized and railroad power plant was put in shape to afford fire protection about three days after cleaning operations began.

One bad condition which delayed operations considerably was the fact that several low spots in the enginehouse and car shop area could not drain properly and held not only water but fuel oil and the vapors of high-test gasoline escaping from ruptured tanks in the vicinity. This condition constituted a veritable tinder box, to such an extent that it was unsafe to use any open lights or operate either engine-driven equipment or electric motors nearby.

In the organized rehabilitation program which was adopted, the initial objective was to get cars moving so as to allow space for switching and the re-establishment of service. In clearing yard tracks, the Santa Fe used all types of wrecking equipment, working some 14 wrecking crews on a 24-hour basis, and sometimes rerailing as many as 65 cars in a 24-hour period. These were cars simply off the rails, but some were wedged in the debris and the bodies of others had floated away. It was a herculean task to move these bodies and trucks to a point where they could be reassembled and rerailed.

In order to recondition journal boxes and air-brake equipment, cars were removed from the adjacent yard to repair tracks and, of course, in this movement with only mud for lubrication, bearings squealed and generally were damaged. In reconditioning the bearings, mud and debris were removed from the boxes, brasses and wedges taken out, journals cleaned and inspected, hollow axles flushed out, cleaned or new brasses and wedges applied as required, boxes repacked with new waste and oil and retainer springs applied to all boxes, whether foreign or system cars. The Santa Fe undertook this additional expense on foreign-line equipment in order to prevent insofar as possible the development of any hot boxes in moving the cars to destination. Foreign lines were not billed for repacking, nor were cars stencilled after the journal boxes had been repacked.

In packing boxes, car department forces used hydraulic journal jacks and worked full crews of men around the clock, repacking boxes on about 350 cars a day. The railroad gives full credit not only to personnel but to labor-saving devices and tools, including these hydraulic jacks, which are said to have paid for themselves many times over in the emergency.

Car bodies which floated away from the trucks were seriously damaged, particularly the running boards of tank cars, safety appliances, etc., and repairs could not be made at Argentine yard on account of flood conditions. These cars were reassembled and moved to shops at Topeka, Kan., about 60 miles, in bad-order trains for necessary repairs.

Box cars and refrigerator cars which had from two to three feet of mud in them were moved to Wellington, Kan., and West Wichita, Kan., for cleaning and reconditioning.

Air brakes were given close attention, AB valves being removed and replaced with serviceable equipment to the fullest extent practicable. On some cars, the emergency and service portions were removed and cleaned thoroughly. Water drained from air brake equipment and piping varied in amount from one to ten gallons. The Santa Fe did not bill foreign lines for cleaning air brakes, but performed this work on all cars regardless of ownership, doing the best job possible under very demoralizing conditions.

In reconditioning motive power, both steam and diesel, the Santa Fe reports that old steam locomotives did not need as much attention as the diesels. On steam locomotives, about the biggest job was to remove the cylinder heads and valves and thoroughly wash out the valve chambers and cylinders. It was found by close inspection that both roller bearings and plain bearings on steam power were relatively undamaged, but a large number of roller bearings in stock were covered with water and badly pitted.

The damage to diesel motive power at Argentine has been described as devastating. The 51 units involved were sent to various shops on the system in order to recondition them as quickly as possible. The distribution was as follows: 18 units to San Bernardino, Cal.; 15 to Cleburne, Tex.; 13 to Topeka, Kan.; three to Fort Madison, Iowa; to units reconditioned at Argentine. Shop forces were put on three shifts so that repairs could be made around the clock.

This vast amount of work included: removing engines from the chassis of switchers; removing engines from the power plants of road-type power; dismantling all engines, cleaning them out thoroughly and putting in new pistons and rings or bearings, depending on what was required; removing main generators and traction motors, for drying out, including high-voltage wires in the power plants. Fortunately only about ten traction motors failed to pass the required tests after being cleaned and dried out. Only one main generator out of the entire lot could not be returned to service after drying.

The first difficulty encountered was preparing the diesel units for movement to distant repair shops, it being necessary to wash and repack suspension and axle-journal bearings, lubricate armature bearings and force out as much water as possible. Mud and silt which filled the gear-case boxes had forced out the crater compound. Debris was packed inside the traction motors, to such an extent that fire hoses were used for several hours on each unit washing out the motors to permit rotation of armatures without further damage. In some cases it was necessary to shovel away mud in order to get at the traction motor inspection covers.

Some difficulty was experienced with the movement of these locomotives, especially switchers with plain journals, as a result of pitting. Excessive damage oc-

Misplaced Kansas soil

curred to the control equipment, wire shunts, coils, terminals, voltage regulators, load regulators, control panels, contactors, etc. The majority of this equipment had to be completely dismantled, cleaned, baked and reassembled. In addition to this overhauling and efforts to reclaim this material, it was necessary to renew a large percentage of operating coils, voltmeters and ammeters, push-button switches, fuse clips, relays, resistors and contacts. Although these appliances appeared to be dried and checked satisfactorily, after the work was completed, many developed open circuits several days later. This damage is believed to be a result of electrolysis and the formation of verdigris.

Washing down electrical cabinets and equipment as soon as possible and spraying with a petroleum base cleaner or oil tends to reduce corrosion. Exposed wiring painted with insulating paint experienced little damage. Exposed varnished cambric wire cable suffered severe damage in many cases. No defects were found with the neoprene-type wire cable, indicating the ability of this type of cable to withstand submersion without deterioration.

Main generators, traction motors, auxiliary generators and motors after being dismantled were thoroughly washed down before drying. Attempts were made to use a large dry kiln, also a heat-treating furnace, for drying traction motors and main generators, but each proved unsuccessful. Reasons included inability to obtain sufficient temperature in the dry kiln; lack of automatic controls on the heat-treating furnaces to maintain a constant temperature, requiring armatures to be placed in a tightly-closed pit at approximately 300 deg. F. and allowed to cool; and inability to carry off moisture fast enough in the heating and drying operation.

Steam heaters with forced-air blowers and infrared lamps were used on main generators in place and found to be inadequate. Nor was it possible to clean generators properly and the pitting condition of armature bearings necessitated dismantling all generators and motors.

The armatures of four main generators were short circuited in endeavoring to use the internal drying method. One armature was damaged, two generators meggered zero after approximately three days running and were then removed from the locomotive. One generator was actually returned to service by this method.

Extensive use of infrared lamps was helpful for both frames and armatures but necessitated three to four days drying, and it was impossible in most cases even then to secure a satisfactory insulation test. This led to further experiments resulting in the adoption of gas-fired annealing furnaces, equipped with temperature-recording instruments. By operating full blower and pilot lights as needed to maintain a temperature between 275 and 300 deg. F., it was found possible to dry two main generators and eight traction motors simultaneously in 18 to 36 hours.

Care was exercised with commutators which would not readily dry out, as overheating would have caused them to rupture. On most main-generator and traction-motor commutators, it was necessary to remove one commutator V-ring bolt and siphon out water trapped within the commutator and at the same time allow steam to escape during the drying process.

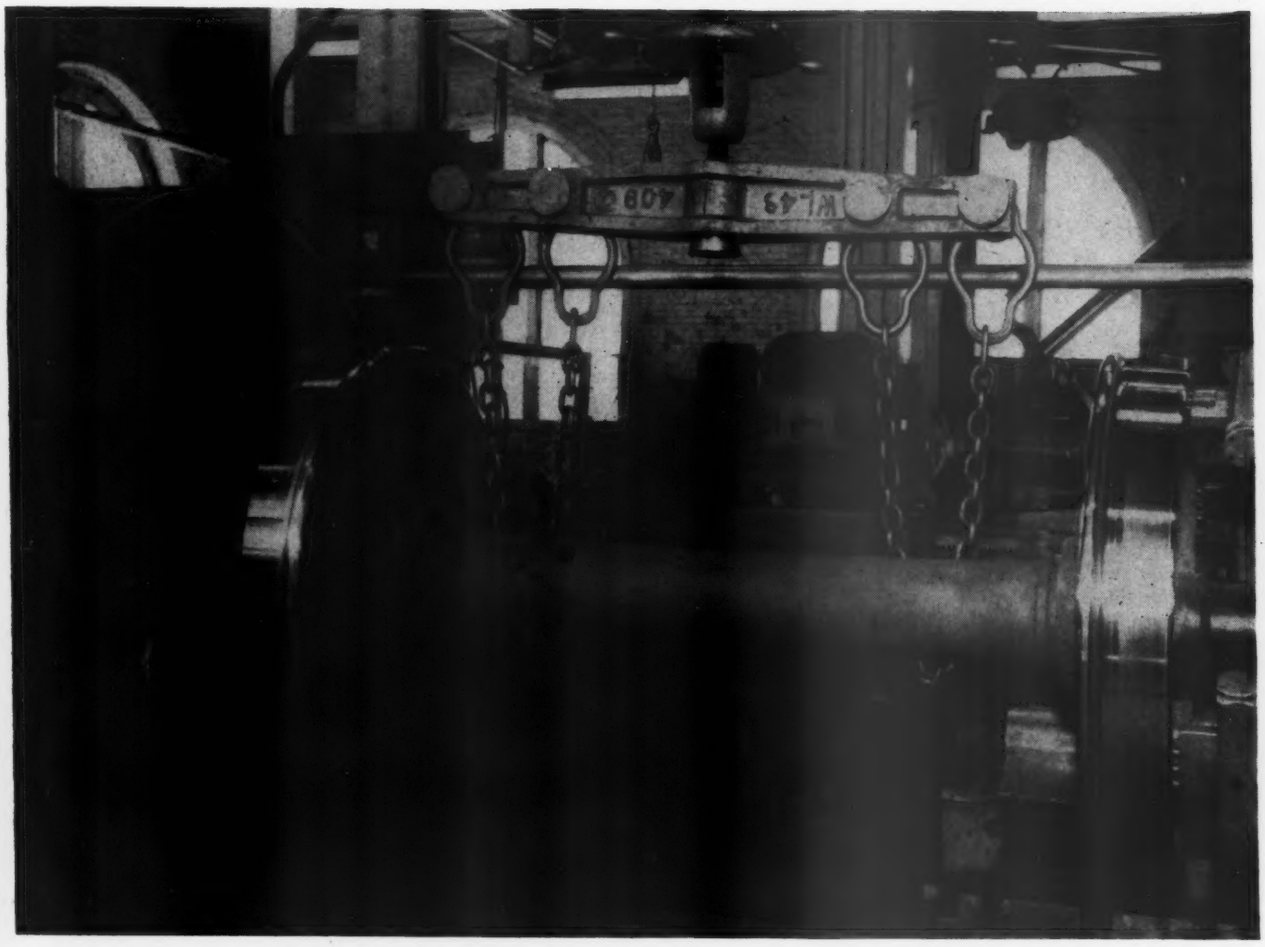
After this drying-out period, armatures and commutators were cleaned by the use of corn meal and sand-blast guns with considerable success at shops not equipped for regular handling of such equipment. In regular traction-motor and armature shops, the above repairs were handled in the usual baking ovens for drying.

Experience showed that, regardless of the drying method used, it was imperative that ventilation be provided to give the air circulation required for removal of the moisture. Armature bearings were renewed because of pitting in practically all of the rollers and races. Frames and armatures were thoroughly washed with a water hose, as silt and mud seemed to respond only to water. Cleaning solvent tended to form a light film or paste that could not be readily removed when dry.

One diesel engine was thoroughly washed and cleaned and an attempt made to load test this unit without removing the engine or generator. This was not successful, because of mud and silt which worked through the engine parts. During the load test, excessive vibration reached a point dangerous for further operation. The engine and main generator were then dismantled and mud was found lodged inside and back of generator blowers and other engine parts, throwing the equipment out of balance. To obtain satisfactory engine performance it was necessary to strip and rebuild all engines.

One fact noted was that crankshafts not Turco-hardened were pitted, but all main and crankpin bearings hardened by this method were found not to be affected.

The 51 flood-damaged diesel units were moved from the ravaged area August 1 and all but two units were in operation by August 17. Approximately 50 truck loads of dirt were removed from these units during the cleaning process. All but one generator and about 10 traction motors passed the required tests after being cleaned and dried and were returned to service.



A pair of steel wheels being turned in 52-in. car-wheel lathe on the S. P.

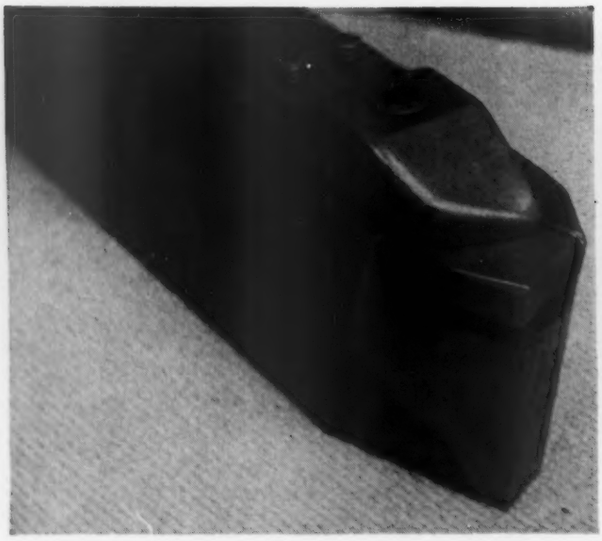
Turning Steel Wheels with Carbide Tools

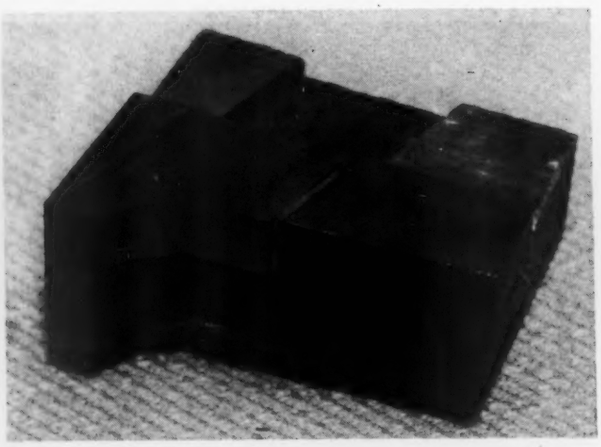
STEEL wheels for steam and diesel locomotives, tenders, passenger and freight cars of the Southern Pacific are turned because of tread or flange wear, on 52-in. car-wheel lathes specially designed for this operation and using carbide-tip cutting tools. One of the machines, installed at the Sacramento, Cal. shop is shown in an accompanying illustration.

The pair of wheels to be machined is placed between the lathe centers and four air-operated clamping dogs are brought into position on the outside rim of each wheel. These clamping dogs equalize themselves during the machining operation so that the pressure of the dogs on the wheels is never more than that required to hold the wheels securely while a cut is being taken. This prevents any warping of the wheels with the result that the finished wheels are concentric within .002 in. The cutting tools are held in a four position revolving turret tool head which is secured to the tool slide.

Until recently, lathes in serice in Southern Pacific wheel shops were capable of a top speed of only 2 r.p.m. which necessitated the use of high speed tools. A solid piece of high speed steel, 1 39/64 in. in diameter by 2 11/16 in. long and tapered to fit into a tool holder, was used for rough turning the tread and flange. The flange was then rough formed using a flange tool and following this, a forming tool shaped to the correct contour was used to finish the wheel to size. The operation was then completed by machining the 5/8 in. radius on the outside edge of the tread with a radius tool.

Wheels which have been in service for a period of time become hard, due to flat spots and pieces of metal





▲ Carbide-tip outside radius tool

◀ Carbide-tip tread-turning tool

being imbedded in the tread, and this caused frequent burning of the speed tools. Also, the amount of stock removal necessary to eliminate the hard spots was sometimes excessive. As a result of these conditions, it required approximately 1 hr. 20 min. to turn a pair of wheels.

During the past few years the Southern Pacific has purchased several new car wheel lathes having sufficient power and speed to operate with carbide tools. Also, the feed mechanism on these new lathes is operated hydraulically and this feature makes possible close control of the required feed.

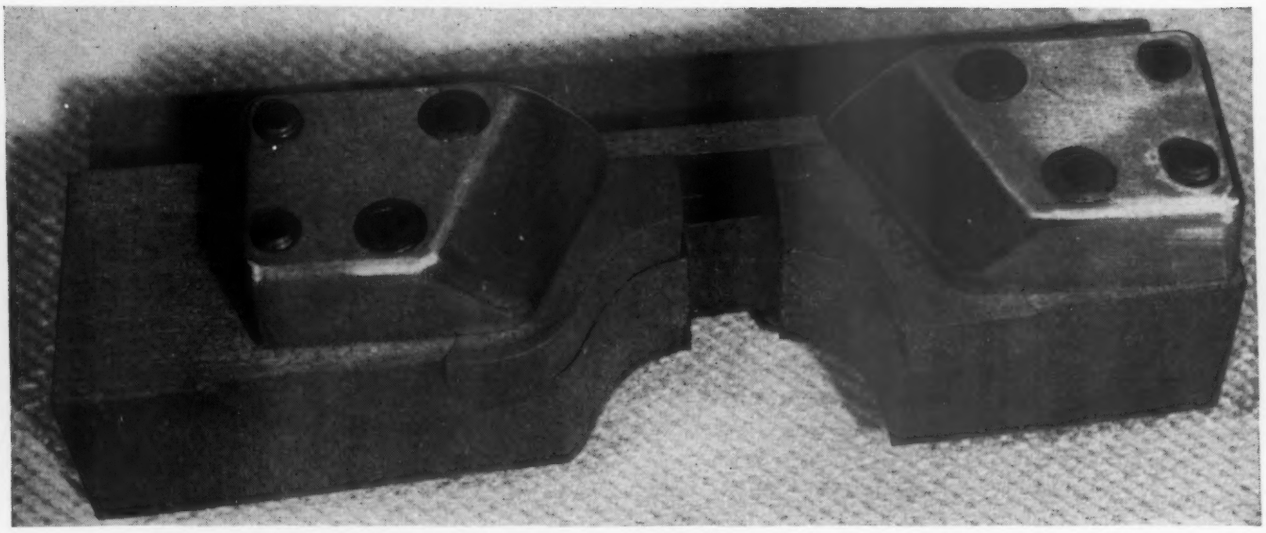
Immediately after installation of the new lathes, experiments with the use of carbide tools were started. The first tool was made using a rectangular carbide tip 1½ in by 1 in. by ⅜ in. brazed onto a 2⅝-in. by 1⅞-in. shank 16 in. long and having a 20-deg. offset. The nose radius of tip was ¼ in. and material was that specified by the manufacturer for normal machining of steel. This tool was used for finish turning the wheel tread and rough turning the flange. The machine was operated at a speed of 20 r.p.m. or 190 surface ft. per min. on a 36-in. diameter wheel, and the feed was approximately .020 in. per rev. of the wheel.

The results obtained were superior to those when using high speed steel, but considerable trouble was experienced with tip breakage and short life. It was felt that some of the tip breakage was due to improper bonding between the tip and tool shank and to the ¼-in. nose radius on the tip being too large which resulted in too much pressure on the tip. In an effort to correct these troubles, a tool holder of the same general design, but on which the carbide tip was clamped, was manufactured. The tip was redesigned so it had cutting edges on all four sides which increased the amount of service obtained, before regrinding was necessary. A grade of carbide having greater hardness was used and the nose radius was decreased to ⅛ in. These changes increased tool life 100 per cent and although tip breakage was reduced considerably, it was felt that further improvements could be made.

It was found that after the tools had been in service for a period of time the surface of the holder upon which the tip was placed had become irregular and the tip was not setting properly. This was overcome by machining the holder ¼ in. deeper and applying a 1⅞₁₆-in. by $3\frac{1}{32}$-in. by ¼-in. hardened tool steel block. The use of this hardened block has practically eliminated tip breakage, because there is now no chance of the seat wearing and allowing the tip to rock and break under pressure. Another improvement was made by polishing the hold down clamp to a high finish. Before this was done the chips would weld themselves to the clamp and eventually destroy it and this difficulty has been overcome by the application of the high polish. The carbide-tip turning tool has proved so successful that it has now been adopted as standard for all car wheel lathes used by the Southern Pacific.

In addition to development work on the tool holders and tips, experiments have been made to determine proper speeds and feeds for the various types of wheels used. Heat treatment applied to steel wheels is determined by the type of service in which they will operated, and the different degrees of hardness obtained affect the speeds and feeds to be used when remachining the wheels. Class AE wheels are relatively soft and can be machined at approximately 20 r.p.m.; Class BR wheels are harder on the rim and the speed is reduced to 17 r.p.m., while the hardest wheels, Class CE, are machined at 15 r.p.m. It should be understood that the speeds given are everage and that changes in metal structure due to temperature, flat spots are imbedded particles of foreign matter may make it necessary to vary the speed during the machining operation. A feed of .020 in. per rev. will normally produce a satisfactory finish on the wheel tread, but as with the speed, this may be varied depending upon the condition of the wheel. Education of operating personnel in the proper use and application of carbide tools is essential in order that best possible results will be obtained.

During the period in which the tool described was being developed, a flange tool made of high speed steel was used for finishing the flange. Since that time a carbide-tip flange-finishing tool has been designed. The cutting portion of the tool is made in two sections to reduce breakage and also to provide easy renewal if one side is damaged. In the original design of this tool, the carbide tips were brazed onto a steel body. However, the great difference in expansion and contraction of the two metals resulted in stresses which caused the tips to fracture after cooling. Another difficulty was experienced due to the fact that the tool



Carbide-tip flange tool

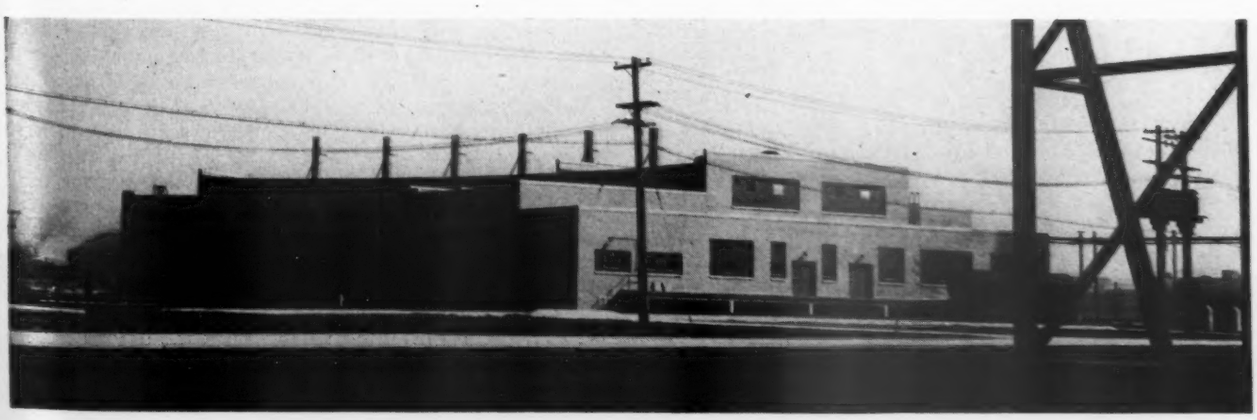
was the exact shape of the finished flange, which made it necessary to feed the tool into the work. With the lathe operating at 20 r.p.m., there was too much contact area for the tool, resulting in considerable tool chatter and a poor finish. It was then decided to separate the two tips and use a side cutting action and this change materially reduced the chatter marking on the wheels. However, frequent regrinding of the tips was necessary and this caused some chipping. The next step was to design a tool having the tips clamped on instead of brazed. This eliminated the tool chattering, but cratering of the tool edge was still prevalent. A small negative rake ground around the cutting edge of the tip was found to be the answer to this problem. Previously the tips had to be reground after turning two pairs of wheels, but since the negative rake has been used, an average of 20 pair of wheels can be machined before appreciable wear takes place. By skillful blending of the flange to the tread, the lathe operator is able to produce a perfect wheel contour.

The final operation in machining a pair of wheel is the forming of the $\frac{5}{8}$ in. radius on the outside of the tread. The tool used for this operation is also shown in one of the illustrations. This is the only tool with brazed tips still used in wheel turning and S. P. is at present developing a tool with clamped on tips for this purpose.

The use of carbide tools for turning steel wheels has reduced the time required from 1 $\frac{1}{3}$ hr. to approximately 27 min. The average time for each of the various operations is as follows: Loading, 4 min.; turn treads and top flanges, 9 min.; form flanges, 10 min. 30 sec.; form outside tread radii, 35 sec.; unloading, 3 min.; total time per pair of wheels, 27 min. 5 sec.

In addition to time saved in the machining operation, another advantage in the use of carbide tools is that the service life of the wheels is lengthened. This is due to the fact that less stock removal is necessary when using carbide tools. The Southern Pacific has found, in many cases, that it is possible to obtain an additional turning on a pair of wheels which would have been scrapped if high speed tools were still in use.

* * *



The Nickel Plate's new Chicago 8-stall combination diesel and steam enginehouse placed in service October 1 will handle an average of 19 diesel switchers, 24 road freight steam locomotives and 4 diesel passenger units. The two stalls nearest the camera make up the diesel section of the house. The steam servicing facilities include the six inside stalls plus a lighted outdoor pit. Complete mechanical turn-around inspection and servicing is given to the road's modern efficient 2-8-4's in an average time of one hour following a 270-mile run from Bellevue, Ohio, but this can be done in as little as 25 min. if the locomotive is needed in a hurry

Why Are Diesels That Way?

Seventeen questions frequently asked about locomotive characteristics, and about features of locomotive management on the road

[This paper was presented before the Railway Fuel and Traveling Engineers' Association at its annual meeting at Chicago, September 17-19, 1951. The author, C. H. Morse, Jr., is manager of the diesel service department, Fairbanks, Morse & Co., Chicago.—Editor.]

IN THE course of your work, you are no doubt asked many questions about diesel locomotives. It may be interesting to take up some of the questions which we are frequently asked and to give you our versions of the answers. In the following, we have tried to keep our answers general in scope rather than applicable to Fairbanks-Morse equipment alone. In some of the items, we have endeavored to provide information either not covered or not fully explained in the instruction books usually available.

What does the horsepower rating of a diesel locomotive unit mean? How does it affect the ability of the locomotive to handle a train?

The horsepower rating of a diesel locomotive unit is the engine horsepower into the main generator for traction purposes. The diesel engine actually develops more brake horsepower which is used to drive auxiliaries such as the air compressors, the radiator fans, blowers, etc.

The rating has no effect on the tonnage which the locomotive can start. This tonnage depends on the weight on drivers and on the factor of adhesion provided by the rail conditions at the time the start is made. At speed, a locomotive of higher horsepower rating will either handle the same train at a higher speed or a heavier train at the same speed. On a hill, however, a locomotive composed of the same number of higher-rated units will handle no greater tonnage without "going into the red" but it will maintain a higher speed with the same tonnage.

This similarity of tonnage ratings assumes that the locomotives have the same gear ratio and wheel size and also have traction motors of the same characteristics. If these items differ, the tonnage ratings will not be the same. At speeds above minimum continuous, these factors will not have any important effect and the comparative performance will be determined by the locomotive unit horsepower ratings.

Why do we have all this electrical equipment such as main generator and traction motors and control system?

The main generator and traction motors are, primarily, a means of transmitting the power of the engine to the

wheels. So far, this equipment represents the only practical method for doing the job.

We have a diesel engine as the source of power, running at a steady speed and producing a practically constant torque when the locomotive is operating at full power. On the other hand, we need high torque at the wheel tread at low speed to start a train or haul it up a grade. Then, on level track, we use all the wheel torque available to maintain speed and make the time. It should be remembered, in this connection, that wheel torque is what produces tractive force and locomotive drawbar pull. Also, tractive force (or wheel torque) times speed (or wheel r.p.m.) is approximately constant while the engine is at full throttle. When speed increases, tractive force falls off and vice versa. The electrical transmission allows us to meet these requirements with an efficiency of approximately 82 per cent and not too much trouble with the equipment itself.

If we could make locomotives that would never run faster than perhaps 20 m.p.h. and always in the same direction, about all the controls we would need would be a throttle to regulate engine speed. But, since locomotives must reverse and make speeds up to 100 m.p.h. or better, the galaxy of reversers, contactors, relays and switches is something we will have to put up with.

Why do the instruction books stress "minimum continuous speed" and "maximum speed"?

A limit is set on the amperage which the motors can stand under continuous operation and a locomotive speed can be determined at which the load meter will indicate this maximum permissible amperage. This speed represents a minimum which must be maintained on the ruling grade. If a greater tonnage is tied on, pulling the speed down below this figure, the loadmeter will go "into the red" and the locomotive will be overloaded with the possibility of damage to the electrical equipment.

The maximum speed limitation is purely for mechanical reasons. If the traction motors turn over too fast, centrifugal force in the armatures can cause damage. The locomotive maximum speed is simply the road miles per hour which will cause the motors to rotate at the specified top r.p.m.

Why do gear ratio specifications differ and how does gear ratio or wheel size affect minimum continuous and maximum speeds and locomotive performance?

In listing gear ratios, some differences exist. One manufacturer will give the pinion tooth number first and follow it by the figure for the axle gear teeth such as "17:62." Another builder will reverse the numbers and give "62:15" as a specification. Note, by the way, that the total of teeth is 79 in the first case, 77 in the second. This variation is simply due to difference in design of the gear train. But either builder will generally stick to the same total-teeth figure through his range of gear ratios. That is, we can expect 19:60, 18:61, etc., in the line of the first manufacturer, 61:16, 60:17, etc., in the second. This rule does not hold on some gear ratios for low speed, heavy pull locomotives where gear manufacturing considerations make a change necessary. A "high" gear ratio is ordinarily considered as being one used on high speed locomotives.

To determine whether one gear ratio is higher than another in any particular range of ratios, compare the pinion teeth figure in any given range—the greater the pinion teeth, the higher the ratio. Between gear ratios of different manufacturers, this comparison may or may not be correct due to differences in the total-teeth figures.

The traction motors will be turning over at the same r.p.m. whenever the loadmeter is at the top of the continuous operation zone, irrespective of gear ratio or wheel size. So, with a higher gear ratio or larger wheels, the locomotive will be running at a higher speed when the traction motors are at this minimum continuous r.p.m. Similarly, the maximum permissible speed will be higher as, with a higher gear ratio or larger wheels, a greater road speed is possible without exceeding the allowable traction motor r.p.m.

So long as a locomotive is not loaded down beyond rated tonnage nor called on to operate above its maximum speed, gear ratio and wheel size make no difference in the way it will handle a train.

Why is field shunting or transition necessary?

As soon as a diesel locomotive begins to move, the traction motors start to generate an internal voltage which opposes the voltage of the main generator. This is known as counter electro motive force—c.e.m.f. for short —and is, in effect, an electrical back pressure. Thus the generator has to put out more voltage to overcome this c.e.m.f. and to force through the motors the amperage which is necessary for motor torque and locomotive pulling power.

As the locomotive speed increases, the c.e.m.f. goes on up. More and more main generator voltage is required. Finally the voltage appoaches the limit for which the main generator and its excitation system was designed. Now something has to be done about it because, if the locomotive speed increases further, the main generator will be unable to produce sufficient voltage for full power output. Each diesel engine will begin to unload and the locomotive will lose power.

To meet this situation, field shunting is introduced or, on some locomotives, the motor connections are changed to place the motors in parallel. In either case, the result is to lower the voltage required from the main generator.

If the speed increases further, after the change, the c.e.m.f. and main generator voltage will go up again and once more reach the desired maximum. A second step of field shunting will be necessary or, on some locomotives, field shunting will drop out and the motors will go into parallel.

Still higher speed will necessitate additional steps of field shunting or the reintroduction of shunting where the motors are in parallel. Finally, a last voltage rise will find the locomotive at maximum speed as the limit is approached.

What happens when field shunting goes in?

A field shunt is nothing but a resistor connected, by closing of "M" contactors, in parallel with the traction-motor field windings. Part of the motor current then flows through the resistor instead of the field winding. This diversion of current weakens the strength of the traction-motor fields and, consequently, the c.e.m.f. is lowered. Then less main generator voltage is required to overcome the c.e.m.f. However, with weaker field magnetic effect, we need more amperes of current flow through the armature to get the same motor torque and locomotive tractive force. This can be seen in the cab by a jump of the loadmeter pointer when field shunting goes in. The resistance of the shunt becomes lower in each step and so diverts a greater proportion of current from the motor fields.

When speed drops due to grade, amperage goes up and voltage down. Now the field shunting steps must be eliminated one by one to keep the amperage from becoming too high. Finally, with all field shunting out, the amperage will rise to red-zone reading on the meter when the speed is down to minimum continuous.

What happens when the diesel locomotive is overloaded

and how can overloading be determined?

When a diesel locomotive is overloaded, it will not maintain the minimum continuous speed on hills. The load meter will go into the red and the electrical equipment will suffer. This fact can often be employed to check the train tonnage on the first grade encountered which is heavy enough to bring the locomotive down to a speed where the motors are in series-parallel (or series) and all field shunting out. On this first rise, the load-meter reading can be taken and compared with the reading observed on previous trips when tonnage was within limits. If the figure is higher than usual, although perhaps nowhere near the red zone, it is a signal that the train is heavy and the meter may go into the red when the ruling grade is reached. With this warning, it may be advisable to notify the dispatcher that the locomotive is overloaded and that it may be necessary to double the hill unless tonnage is reduced.

What inspection should be made before leaving the terminal?

An outside inspection is recommended. If the locomotive units have been separated for servicing, particular examination should be made to see that the cocks are all open in the connections between units. Where a trailing unit is present, the positions of switches and controls in the cab should be checked. In the engine compartments, oil and water levels, positions of isolation switch handles, setting of ground and generator surge relays, battery-charge meter readings, fuel and lubricating-oil pressures and temperatures are points requiring attention. A quick check of electrical cabinets for rags, tools and foreign material is in order. All hand brakes must be released before moving.

In the operating cab, lights and heater operation are tested and, of course, the usual air-brake equipment check is made. Throttle control is tried out by revving up the engines to part speed with generator field off. Then, with generator field on the reverser in forward or reverse and locomotive brakes applied, the throttle is opened to notch 1 or 2 for a few seconds to see that the load meter pointer comes up slightly, indicating that power control is OK.

Ordinarily, the fireman will make the engine compartment checks but it is the responsibility of the engineman to make sure this is properly done. The main thing, on the inspection as a whole, is to establish a routine and follow it faithfully. If such a procedure is set up, it will be found that a quite thorough inspection can be made in very few minutes.

How can I tell if the locomotive is functioning properly on the road?

Here we assume that none of the alarm systems are functioning to show a definite defect. Rather, we will say, there is doubt as to whether the locomotive is handling the train as well as it should.

The first point to check is engine speed—whether all engines are up to the speed called for by throttle control. If one engine is at idle, the fact is quickly apparent. If none are idling, the throttle-position indicator on the Woodward governor or governor operating mechanism should be checked at each engine. Any lack of proper speed control will show up if the indicator does not agree with the throttle position in the cab.

If the engines are all up to speed, the next question is whether they are loading properly. The load indicators on the governors will help to detect subnormal loading. Or, as a check on the indicators, the load regulator positions can be compared in the different units. Some divergence between the load regulators is normal but if one is fully over at maximum field, for instance, while the others are operating in their usual range, under loading is probable in that unit. Failure of transition or field-shunting control is a possible cause and the contactor positions should be checked by visual inspection to see whether they agree with those in the other units. Failure of loading in any unit may also be due to a variety of other causes although the difficulty may be nothing more serious than a blown fuse or a tripped breaker or loss of control air pressure from a shut valve.

Why the load regulator and what does it do?

Inherently, the engine with its governor is a lazy outfit. It will do no more work than it has to in order to keep the engine r.p.m. up to the speed called for by the engineman's throttle. So the load regulator is provided to control the generator output in such a way that the generator will load the engine to the proper horsepower.

Actually, the load regulator is operated by the governor. If the engine demands too much or too little fuel per cycle, oil from the governor under pressure moves a vane-type servo-motor in the regulator one way or the other. An arm operated by the servo-motor carries a brush over contacts and thus cuts in or cuts out resistance in the excitation circuit of either the main generator or the exciter generator.

When locomotive speed is increasing, the load regulators will move toward maximum field, decreasing the resistance in the generator or exciter field circuit. This is necessary because, otherwise, the voltage of the generator would not increase fast enough to maintain full power output and the engine would tend to unload. Similarly, when speed decreases due to grade, the regulator arms move toward minimum field to increase the circuit resistance and cut down the voltage, thus avoiding overloading of the engine.

The oil passages to the servo-motor have needle vaives by which the speed of movement of the arm in either direction can be limited. One needle valve is set to limit the rate at which main-generator output can rise after power interruptions such as wheel slip or, when starting a train, if the throttle is opened too suddenly.

Are there any special precautions that can be taken to insure good locomotive performance and long equipment life?

Attempting to haul tonnage which sends the load meter beyond the continuous rating zone is a sure way to shorten the life of the motors and generator. It is true that no failure may occur at the time of overload. But, the heating action of overload operation will cause deterioration of insulation which is cumulative in effect. As a result, the equipment may fail at some future time while operating within loading limits and for no apparent reason.

In this connection, we believe it is not generally appreciated that the heat generated in electrical equipment goes up as the square of the amperage. That is, if we have motors with, say, 1,020 amp. continuous rating and run them at 1,100 amp., the increase is only 80 amp. on the meter, or 7½ per cent. The heating effect, however, is more than 15 per cent greater. Or, if the meter goes up to 1,150 amp., the heat generated will be 27 per cent more than at continuous operation.

How high the motor or generator temperatures will actually go, and how much damage may be caused, depends on the time the equipment is exposed to this heating effect as well as such factors as atmospheric conditions, initial motor or generator temperatures, etc. As equipment temperatures cannot be gauged from the cab, play safe—don't go in the red, except temporarily when

starting a train or for such short-time overload operating periods as may be authorized by special instructions.

A few other precautions may be listed as: throttle fully closed at stops and reduced when passing over grade crossing, care in running through water, coming to full stop before reversing, etc.

In general, what can be done in the way of trouble shooting on the road?

When trouble occurs on the road, the first question is to locate the particular nature of the difficulty. An alarm-system indication may or may not give the answer. A hot-engine alarm is a hot engine but a low-oil alarm is probably caused by anything but low oil. Perhaps low oil pressure, yet, but not low oil level in the engine. So the engineman must have a thorough knowledge of the alarm systems—what common defect will operate each alarm.

If there is no alarm to give a clue to the trouble, the diagnosis can only be made on the basis of a good general familiarity with the locomotive and how it works. Again education is the answer.

Having spotted the trouble, the next question is, "Can or cannot anything be done about it?" Actually, anything that he can do on the road will be minor in nature, such as renewing a fuse, etc., and will take a few minutes at the most.

What should be done if engine operation becomes erratic, makes odd noises, etc.?

Shut it down—but quick! It may, however, be advisable to take a quick look at the fuel gauge or fuel-flow indicator first as an engine may make unusual noises and run irregularly when it is starving for fuel.

After shutting the engine down, leave it alone for a while. Removing an inspection cover would serve no useful purpose and may cause crank-case combustion which can be violent.

If a power plant stops or the engine goes to idle, what can be done?

In either of these cases, an alarm will sound on later type locomotives of some manufacturers. On others, a unit at idle will cause no indicator action. Even when an alarm system does function, the label on the indicator is far from a positive clue to the cause of the trouble in some instances. For example, a "No AC Voltage" or "Alternator Failure" alarm can be and usually is due only to the fact that the engine is stopped, not to any failure in the AC system.

When an engine goes to idle or fails to respond when the throttle is opened, it quite apparently is not getting throttle control. Therefore, the causes for lack of control should be checked, such as tripped ground relay or, on locomotives with ac auxiliary drive, "No AC Voltage" relay out. On some Fairbanks-Morse locomotives, a generator surge relay is used which, when tripped, will bring the engine to idle. Thus, individual makes and models must be studied to determine just what will cause an engine to drop to idle speed. If an engine will not speed up when the throttle is first opened, we can have the additional possibilities of isolation switch in "idle" or a stuck starting contactor on most types.

For a stopped engine, overspeed tripped or lack of fuel are probably the most common causes. In checking a stopped engine, the points for "Engine at Idle" should also be investigated as there is always the chance that the engine went to idle first and then stopped when the throttle was moved to fifth or sixth notch.

What can be checked if the "low oil pressure" alarm sounds and the engine stops or goes to idle?

Except on locomotives using late Woodward governors, with the low-oil-pressure shut-down feature incorporated, look first for all possible causes of stopped engine *but* low oil pressure. In fact, low oil pressure itself is quite an uncommon occurrence and, when encountered, is often not due to any defect in the engine lubricating system proper. Instead, it is caused either by low viscosity of oil when heated by lengthy periods of full power operation or by an "undershoot" action of the governor if the throttle is closed rapidly from the higher notches to idle or by a combination of the two conditions. Also, we can get a low-oil-pressure engine shut down even with normal pressures if the shut-down devices are set too high, particularly if the oil is hot or if the throttle is closed too quickly.

On the road, with governors other than the Woodward type described previously, we check for other causes of stopped engine. Then the engine is started and the oil pressure observed closely while the engine is idling and when it speeds up on the line. An engine with the late Woodward governor stopped with the button out and the "yellow bell" sounding really means low oil pressure, though the lack of pressure may have been due to hot oil or governor "undershoot" or both. The engine is started and allowed to idle. If the low oil pressure condition still exists, the engine will shut down again in about 40 sec.

If it is found that engine shut downs occur after topping a grade, or when starting down hill after a period of full power operation, hot oil or governor action or shut-down device settings can be suspected. On succeeding grades, the throttle can be held open to notch 2 for a short time before going to idle. This will usually allow the governor to stabilize and prevent speed underswing when the final movement is made to idle. If the trouble persists even with this throttle handling, the cause is probably not governor undershoot but one of the other two mentioned. The condition should, of course, be reported.

What is to be done when the ground relay trips?

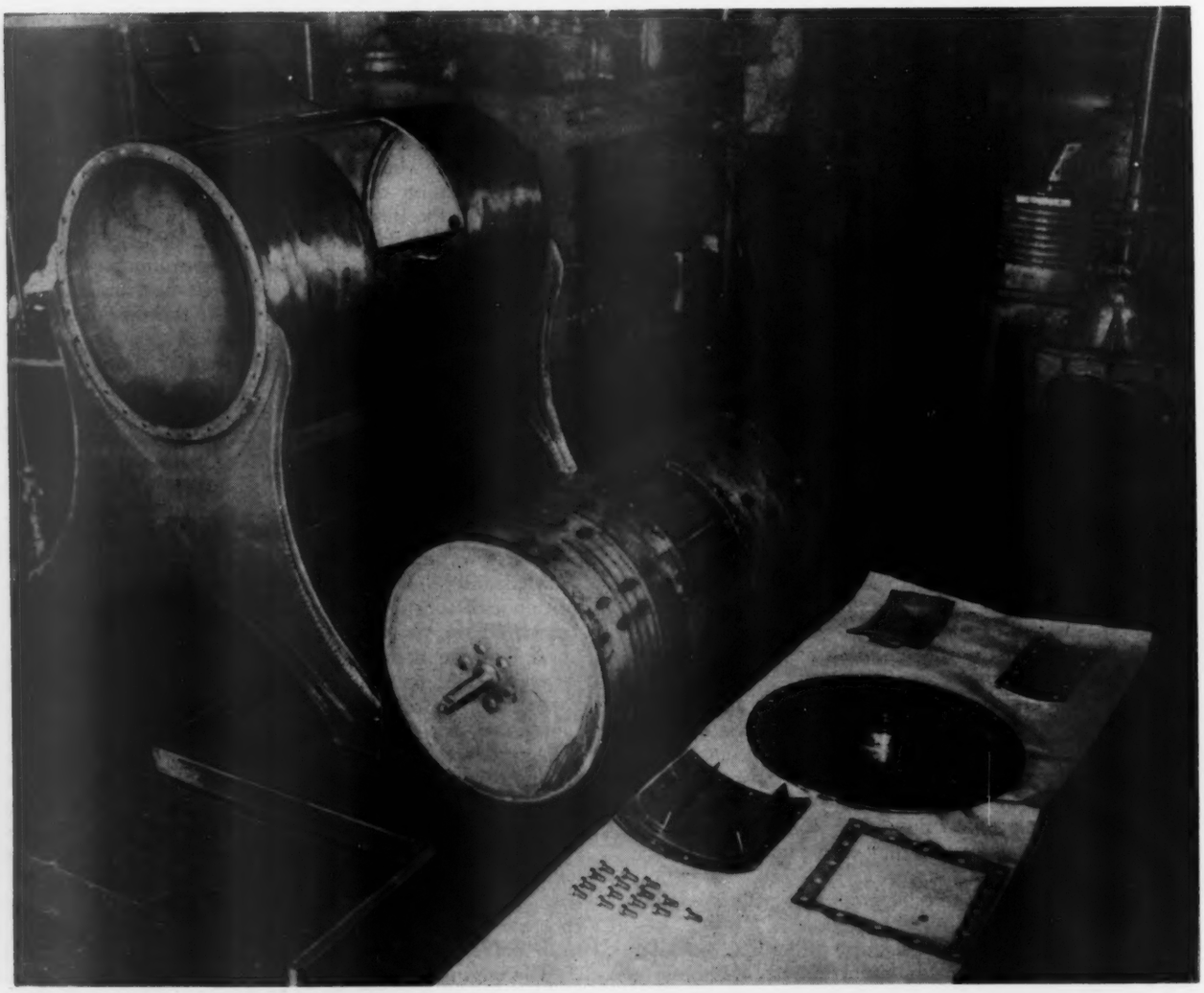
The engine should be isolated, the relay reset and the engine put back on the line. If the relay trips repeatedly, the first step is to cut out the motors, or the trucks, one by one, on locomotives provided with such control arrangements.

When the relay trips in all positions of the cutout switches, if it is possible to get on over the road with the unit out of service, this is definitely the best course. But if the unit must be used, even if only to get into clear, pulling the ground relay switch will allow the unit to be continued in operation. Various railroads have their own rules on the allowable use of this ground relay cutout switch.

On hot engine alarms, what can be done on the road?

Not much. The water level on the cooling system can be checked and the shutters examined to make sure they are opening fully. Many locomotives have levers for manual operation of the shutters if necessary. The fans can be checked for proper operation but, if they are not running, there is probably no action which can be taken on the road outside of testing the fuses used in some radiator-fan motor circuits.

Cooling system temperatures may go well above normal in hot weather although no defect exists. The systems are designed to hold the cooling water temperature down to normal so long as the atmospheric temperatures do not exceed some particular figure—usually 75 to 80 deg. If the weather goes above this temperature, the cooling water may go up as well. This action represents no defect and no action need be taken.



▲ Construction parts of the harmonic-balancer spring pack cleaning machine

Spring Pack Cleaning Machine

Harmonic balancer spring packs can be cleaned in about one hour by one man using the machine shown in the illustration. One set fits in a drum 34 in. long and 17 in. in diameter and is revolved in a mixture of soluble oil and sand, using a 5-gal. bucket full of sand with 3 gal. of oil.

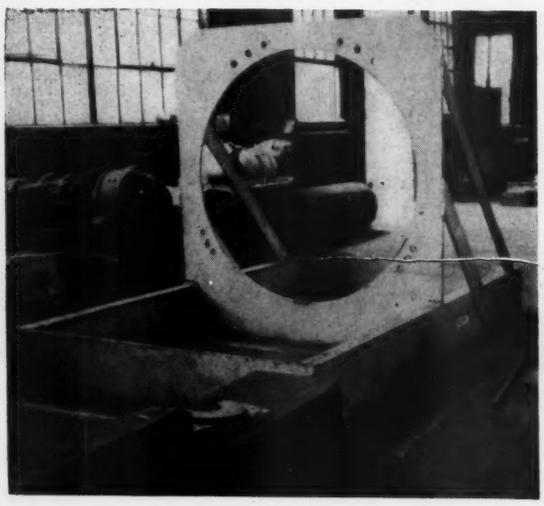
The drum is made of stainless steel, $\frac{3}{16}$ in. thick. Inside are 7 strips of $1\frac{1}{2}$-in. angle iron welded lengthwise to agitate the contents. The drum is driven at 25 r.p.m. by a 1-hp. electric motor and it turns on two ball bearings. To protect workmen from all moving parts the revolving drum is encased within a stationary drum, also made of $\frac{3}{16}$-in. stainless steel.

The revolving drum is constructed by flanging over the edges of the cylindrical portion and bolting the end pieces to the edges through a rubber gasket. The drum is loaded through a door 8 in. square which is closed off during the cleaning operation by a plate. The stand on which the drum is mounted and revolved is made of $\frac{1}{4}$-in. plate and $1\frac{1}{2}$-in. angle.

➤ Spring pack harmonic balancer sets are cleaned in one hour on this cleaning machine. The air motor shown above has been replaced by a 1-hp. electric motor

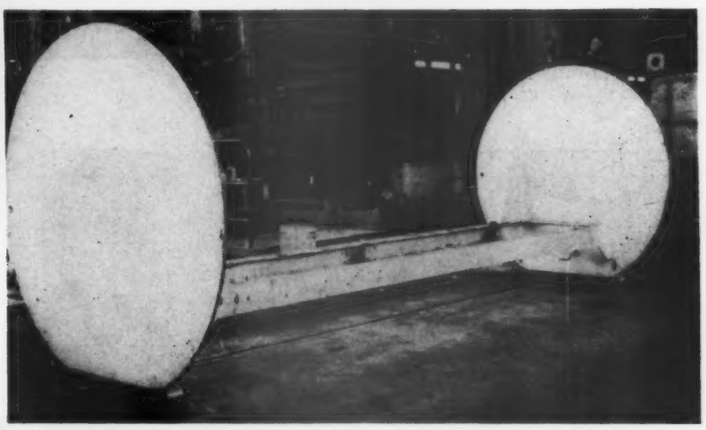
Shop Ideas from the Katy

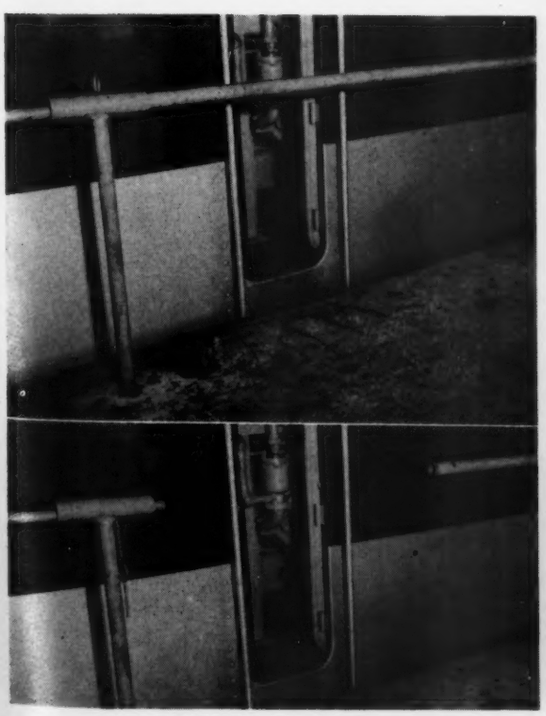
▲ Layout for removing armatures from E.M.D. generators. The housing is supported on the center section, which slides back and forth, while the bearing end of the generator is supported on the cradle of one of the jacks. A shaft rests on the remaining jack and extends into the opening in the end of the generator armature. Raising both jacks suspends the armature, permitting the center section of the stand with the housing to be moved with ratchet hoists until the housing clears the armature. Putting a sling around the armature holds it for removing and carrying the stub shaft



▲ Generators from Baldwin and Alco locomotives while held in the above stand, are cleaned by blasting with ground corn cobs at the Parsons, Kan., shops of the Missouri-Kansas-Texas

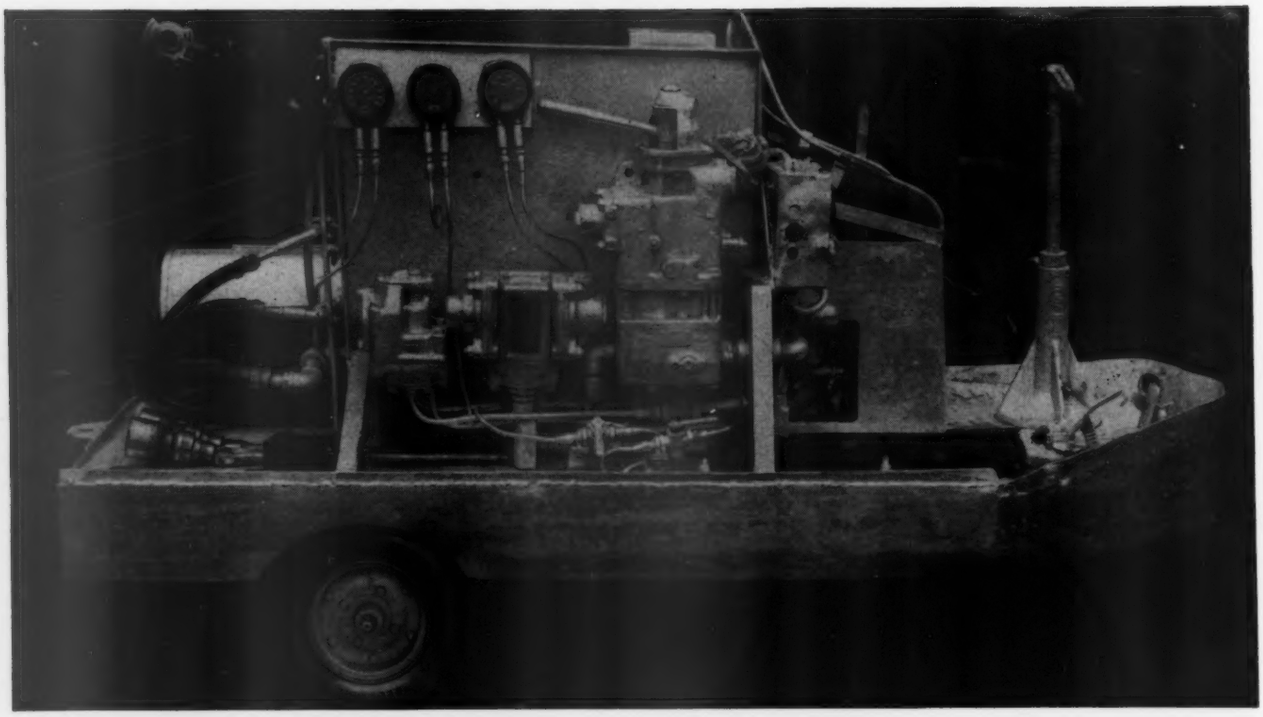
▼ Crankshaft removal and application stand used at Parsons, has two circular sections of 1-in. plate mounted on rollers and can be turned by hand. The crankcase is located and secured by six bolts. The stand is revolved and positioned by use of four dowels



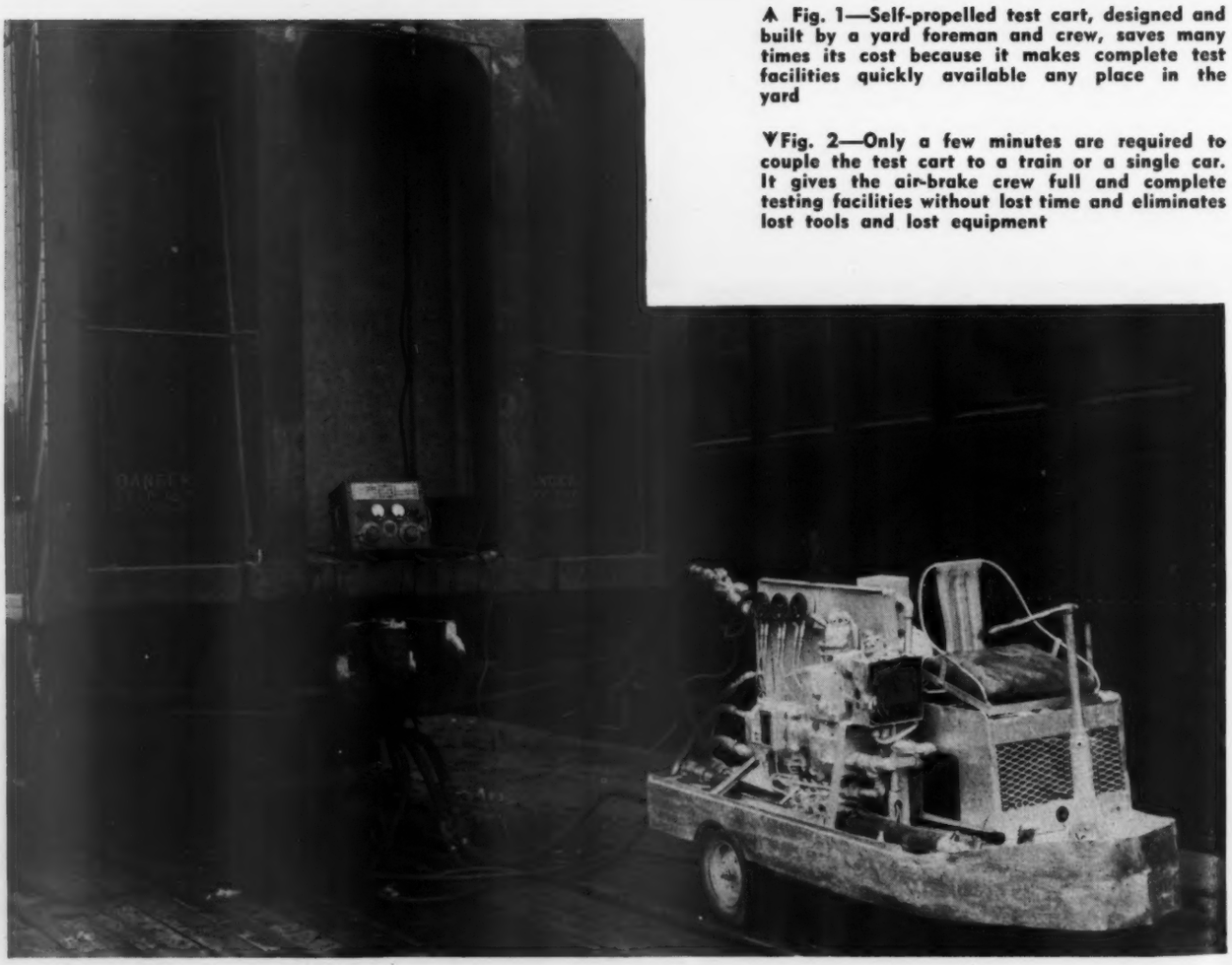


◀ Where diesels with different distances between door openings are handled, telescoping guard rails can be opened at any point or points for access to the inside of the locomotive. This installation is made of three different sizes of old flues, secured in place by the pin in the post as shown in the upper section. The pipe slides out for entering the doorway as shown in lower section

▼ Stand for polishing crankshaft throws. The crankshaft revolves on three pairs of ball bearings while driven by an air motor through a plate bolted on the end with a boss that fits in a drill chuck on the motor. Polishing is done with crocus cloth, either by hand or by inserting it in split hinged members with holes the size of the connecting-rod bearings



▲ Fig. 1—Self-propelled test cart, designed and built by a yard foreman and crew, saves many times its cost because it makes complete test facilities quickly available any place in the yard



▼Fig. 2—Only a few minutes are required to couple the test cart to a train or a single car. It gives the air-brake crew full and complete testing facilities without lost time and eliminates lost tools and lost equipment

Maintenance of Car and Diesel Clasp Brakes*

THE fundamental reason for practically all brake maintenance is safety. Safety is the primary and dominant factor in anything having to do with brakes for the reason that brakes are the basic safety system of a moving train. Brakes, brake parts, and brake mechanism must not fail; the brake must be built and must be maintained so that normal wear or malfunction of some part will not prevent the brake from stopping the train. The entire philosophy of brake design and maintenance is based on this formula: Reliability must take precedence over all other considerations.

When reviewing the work necessary to keep a braking system safe, it is apparent at once that there are two general kinds of brake maintenance. The first is repair maintenance, that is the repair or replacement of some part or mechanism which has failed or is worn to the condemning limit. Such work is done following daily inspection or at the time of general truck overhaul. The other kind of maintenance is preventive maintenance. This is the kind of work which does not wait for a failure, but attempts by inspection and adjustment to anticipate the trouble and to do something about it before it occurs.

In the railroad field, because of our being "safety-conscious," we have devoted the greatest amount of our attention to making brakes absolutely reliable and dependable; the brake designer has been asked to design and build a brake which will be so reliable that it will safely run for about half a million miles without heavy repairs.

Operating conditions of the modern passenger train have undergone considerable change in recent years and these changes have raised serious maintenance problems. First, there has been a substantial increase in speed: 50 and 60 m.p.h. schedules have been increased to 80 and 90 and even higher. This has brought an increasing importance to safety and has greatly multiplied the problems of keeping the mechanism in proper working order when it is subjected to the intense vibration accompanying high speeds.

Second, the idle hours per day available for maintenance work have been drastically reduced. Years ago passenger equipment was called upon to make the Chicago-Denver run two or three times a week. Today the equipment must make the run every day, seven days a week. There is no question of having the train ready to run tomorrow; it must be ready to run today. Much modern passenger train equipment is actually only available for maintenance work for a few hours once a day, and in some cases once every three days, so that work must be done quickly and on a carefully planned schedule. Third, because of the demands for improved performance, brake equipment on the passenger train is no longer the simple mechanism which adequately served on earlier equipment. Electric and pneumatic control apparatus has become more vital and complicated. Operation and adjustment of the brake mechanism has become increasingly complex.

This has brought large increases in the amount of skilled labor required and need for expensive maintenance equipment and facilities. Meanwhile the cost of all labor, skilled and unskilled, has steadily increased.

It appears therefore that operation of high speed passenger trains demands increased maintenance work done in less time and with more expensive labor and materials. All of which means that the air brake man must give it much more careful thought than he has in the past.

Preventive maintenance breaks down into two separate factors. First, inspection, that is, the discovery of danger signals, the constant search for trouble before it happens. How often and thorough and detailed should this inspection be? What are the danger signals to look for and what is the surest and most economical method of finding them? Second, once the danger signals are discovered, what should then be done about it?

When safety is involved, there is no question—correction must be complete and immediate. Assuming that no parts are broken, worn out or in an inoperative condition, there may be a difference of opinion as to what constitutes safe and suitable condition for service. We shall outline what we believe to be minimum requirements.

Before attempting to examine the details of how this problem should be approached, it may be well to run through a typical operation involving a modern high speed train and sketch out the nature of the maintenance work which must be done to keep its brakes in order.

Maintaining the Empire Builder

We have chosen for this purpose the "Empire Builder," operating daily Chicago to Seattle over the combined facilities of the Great Northern and the Burlington. It is similar to the Denver and Nebraska Zephyrs, North Coast Limited and the Western Star. All of these trains are equipped with clasp brakes and approximately 250 per cent braking ratio.

The Empire Builder is a typical high-speed, modern streamliner train of 15 cars, operating daily between Chicago and Seattle, 2,211 miles, with diesel locomotives most of the way, and electric locomotives over the Cascade Mountains. The train operates across all types of terrain with long stretches of water level track at both high and low altitudes, with normal cruising speeds of 80 to 90 m.p.h., and over severe mountain grades which involve long continued heavy braking. Great extremes of temperature are experienced during a run, including some of the worst cold and icing conditions to be found anywhere.

The train is equipped with automatic sanders on all cars, electric-pneumatic brake control standard clasp brakes, 18½-in. shoes and with three different types of anti-wheel slide devices.

To test such trains in the yard, we use the test device mounted on a chore boy shown in Fig. 1. It is equipped with a complete set of HSC locomotive brake schedule, with proper air and electric connectors to the yard and train. A motor generator is used to supply current for the electro-pneumatic brake.

After the test device is coupled to the train, two me-

* Abstract of a paper presented before the Air Brake Association by a committee on clasp brake maintenance of which H. I. Tramblie, air brake engineer, C.B.&Q., is chairman.

Fig. 3—A set-up which provides complete facilities for handling air-brake cylinder conditioning and assures that the job is done completely, accurately and quickly at low cost by eliminating waste labor

Fig. 4—Power operated fixtures not only save labor and time but assure uniform quality work. Here the piston and spring are ready for assembly with the head

Fig. 5—An air motor driven spinner for polishing brake cylinder sleeves not only saves time but does a better job than makeshift methods, and makes a workman proud of his job

chanics start along the train, one on each side, to check for leaks, position of cut out and angle cocks at the control valves, brake cylinders and between cars. They also run automatic slack adjusters back if necessary, note position of hand adjusters and take up holes in pull rods.

When reaching the rear of the train they open the brake pipe and signal cut out on the rear to insure a full flow of air and to blow out any dirt or moisture which may be in the pipes.

They then return to the head end; one man inside tests the signal valve and hand brake on each car. The other man outside checks the hand brake chains and couplings. When reaching the head end, they make a full automatic service brake application, then one on each side checks the piston travel, marking any necessary correction on the brake cylinders with chalk, they also check the anti-wheel slide devices and car sanders. Electricians at the same time check the electric brake circuits with a circuit checking device and go through the train looking for loose or broken wires in the connectors or plugs. One man returns to the head end, closing the straight air cut out cock on the head end of each car. When reaching the head end he releases the brake, then both men walk the train checking the release and correcting piston travel.

Next, the man at the rear operates the back up brake valve, in straight air, automatic service and emergency. The head man observes that brakes apply and release on the head car during each test. The rear man then signals for an electro-pneumatic application from the head end. After making a full brake application from the test device, the head man opens a switch in the application circuit.

After waiting two minutes, both men walk the train to see that each brake is applied and that there is no noticeable leakage at the magnet valve exhaust or in the hose coupling or cut out cocks and that the relay valves are not pumping.

The brake is then released, and one man walks the train to check release and to open straight air cut out cocks. Any defects found are corrected: about two hours and forty-five minutes are usually required for this work on a 15 car train. This time does not include that required for brake shoe change, daily filling of sand boxes or repair and replacement of parts found defective.

TABLE 1—CLASP BRAKE RIGGING ADJUSTMENT AND CHECK CHART

CONDITION	CAUSE	CURE
Piston Travel Too Long	1. Automatic slack adjuster not operating	Remove or repair adjuster.
	2. Automatic slack adjuster run out	Adjust manual slack adjuster or take up hole in top rod.
	3. Worn pins and bushings — slack rigging	Renew worn parts.
Piston Travel Too Short	1. Not adjusted after installing new wheels or shoes	Adjust automatic, manual or pin holes as needed.
	2. Frozen pins or levers in rigging or elongated holes in bushings	Free moving parts and renew badly worn parts.
Brake Shoe Tapered Top or Bottom	1. One-way travel	Reverse shoes.
Brake Shoe Off Wheel Tread or Rubbing Flange	1. Sloppy or worn rigging	Renew worn parts.
	2. Loose or worn brake head	Apply new head.
	3. Balancing device not effective	Repair or replace defective parts.
	4. Bent beam or rigging	Renew damaged parts.
Brake Shoe Burned	1. Stuck brake	Make single car test
	2. Hand brake set	Release or adjust hand brake.
Brake Shoe Loose in Brake Head	1. Worn head	Apply new head
	2. Bad brake shoe key	New key.
	3. Bad slot in shoe	New shoe.

After the engine is coupled to the train, the regular AAR-ICC prescribed tests are made, with the automatic, electro-pneumatic, straight air and also an emergency application.

In addition to the daily routine we have just outlined, there are monthly tests of speed governor control and a monthly check of hand brake operation which must be made on each individual car.

It is important that inspection and maintenance routines such as these be carefully planned by foremen and supervisors so that men will understand fully what they are expected to do and will follow identical routines day after day. This will save time and make certain that the job is done thoroughly.

Table 1 is an example of how brake rigging inspection

and adjustment procedure can be organized. It shows the conditions a mechanic is expected to look for, the causes of these conditions and the proper repairs to be made.

We believe this intensive maintenance is justified. By doing more than the required minimum maintenance, we get three very valuable benefits which are well worth the costs.

The first benefit is a decided improvement in the operation of the brake. Holding piston travel to between two and three inches gives a very sensitive brake with a highly uniform response. It enables the engineer to handle his braking smoothly and with a degree of precision not otherwise possible. Overbraking and overuse of the brake is reduced and there is a very considerable saving of air and fuel.

The second benefit is a marked reduction in brake shoe wear. The Empire Builder and similar trains are consistently showing 25,000 to 30,000 miles on brake shoes. Shoes can quite safely be worn down to the last half inch and still be safe for the 2,200-mile run from Chicago to Seattle, or like mileage on other runs. Brake shoes are *not* changed en route.

The third benefit is a substantial reduction in wear on the brake rigging, with a longer time between shopping periods and a marked reduction of worn parts. High speed operation and destructive vibration go hand in hand. At speeds above 60 m.p.h., a loose or sloppily adjusted brake rigging may be shaken to pieces. It is well known that brake rigging parts wear out due to vibration, not by use.

As an example of how well this extra maintenance pays off, the Empire Builder equipment went into operation at the beginning of 1947, and all six trains operated continuously, without a spare car, for over two years. Not a single car had to be withdrawn from service during this period because of brake trouble. When a spare car became available in the spring of 1949, one car was withdrawn from service for inspection and shopping. Measurements of actual wear on all working parts of the rigging disclosed that, on the basis of some 650,000 miles of service, no serious wear was indicated, and that in all probability the best part of a million miles of wear could be anticipated before it reached the point of requiring renewal of parts.

It appears to us, therefore, there can be no doubt that it is far less expensive in the long run to do a complete, careful and thorough job of preventive maintenance and have the benefit of improved service, long life and reduced repair costs, than it is to do a minimum job and have the disadvantages of poorer service, shorter life and higher repair costs.

Limits of Wear

In setting up the program of maintenance to be followed, it is necessary to fix standards: standards of procedure and standards of wear. These must, of course, be made to fit the individual requirements of each railroad.

It is essential that all parts of the brake rigging shall be maintained in accordance with standard drawings as to levers, pins, hangers, brake beams, etc., to avoid change in braking ratio. Brake rigging parts should be renewed or reconditioned when worn to the following limits:

Auxiliary levers, truck levers, cylinder levers and equalizers: A total surface wear of $\frac{1}{8}$ in. maximum permissible on thickness at all pin connections.

Balance hanger brackets: (Generally $\frac{1}{2}$-in. spring steel) Maximum wear of $\frac{1}{8}$ in. thickness in eye portion is permissible.

Brake beams and brake hanger connectors: Wear on trunnion bushings beyond the hardness penetration, generally $\frac{1}{32}$ in. deep for bushings of this type, will be rapid; therefore, any bushings with over $\frac{1}{16}$ in. wall wear from original outside diameter should be replaced.

Brake hangers and hanger levers: Surface wear of $\frac{3}{16}$ in. total on faces at top and bottom of brake hanger is permissible.

Brake heads: Wear on face of brake heads should not be to the extent that a brake shoe cannot be held tightly by means of a key to the head. A total surface wear of $\frac{3}{32}$ in. on each jaw at the pin hole is permissible.

Brake head balancing devices: With one way travel, tapered wear of brake shoe may be expected. On long shoes this may average about $\frac{1}{4}$ in. per shoe. Occasional shoes may show more than average tapered wear and should be reversed to save waste metal. (The purpose of brake head balancing devices is to permit the head to adjust so that the shoe holds concentric with the wheel in the released position under various conditions of wheel diameter and shoe thickness. Practically all these devices function by providing friction from spring pressure; consequently, maintenance will consist in making sure that adequate spring pressure is obtained. Worn parts should be replaced or built back to new dimensions so that adequate spring pressure is present. There should be sufficient friction so that the head cannot be moved by hand.

Clevises: Surface wear of $\frac{1}{16}$ in. on each jaw at pin hole is permissible. A diametric reduction of $\frac{1}{8}$ in. maximum is permissible in rod portions originally over 1 in. in diameter.

Connection straps: Surface wear of $\frac{1}{16}$ in. pin holes is permissible.

Pull rods: (Generally also applies to brake beam fulcrum, fulcrum brackets and bars, and hanger lever brackets) Surface wear of $\frac{1}{16}$ in. on each jaw is permissible.

Guides and supports: Wear of 75 per cent of the general original thickness of $\frac{1}{4}$-in. wear plates is permissible.

Bushings and pins: Combined wear in assembly of associated brake pin and bushings of $\frac{1}{8}$ in. should be considered maximum on conventional passenger cars, locomotive tenders and diesel switchers; however, a combined wear of $\frac{3}{32}$ in. in a similar assembly should be considered maximum on high-speed passenger cars, tenders and diesel power units.

Any appreciable wear of pins or bushings in a brake system reduces the brake shoe clearance provided in the brake system. A clasp brake is designed to operate at a prescribed piston travel, thus providing a reasonable amount of clearance at each brake shoe, and any appreciable wear of the pins or bushings increases this piston travel; the piston travel is distributed at the various worn pin connections and the remainder becomes brake shoe clearance, which is subtracted from that originally provided.

Worn pin and bushing assemblies and worn brake parts also contribute to noises and other disturbances to passengers. Piston travel of truck-mounted brake cylinders depend on the type of control valve; with UC schedules the rigging is usually designed for 5-in. travel to conform with reservoir sizes.

With D-22 or D-24 schedule, the piston travel should be adjusted for 2-3-in. slack adjuster set at 3 in., particularly in solid trains of this equipment; it has been found desirable to keep the piston travel as short as possible to facilitate the application and release of brakes. When anti-wheel slide devices are used, the efficiency of

Fig. 6—This automatic slack adjuster engine has been throughly cleaned for inspection, lubrication and reassembly

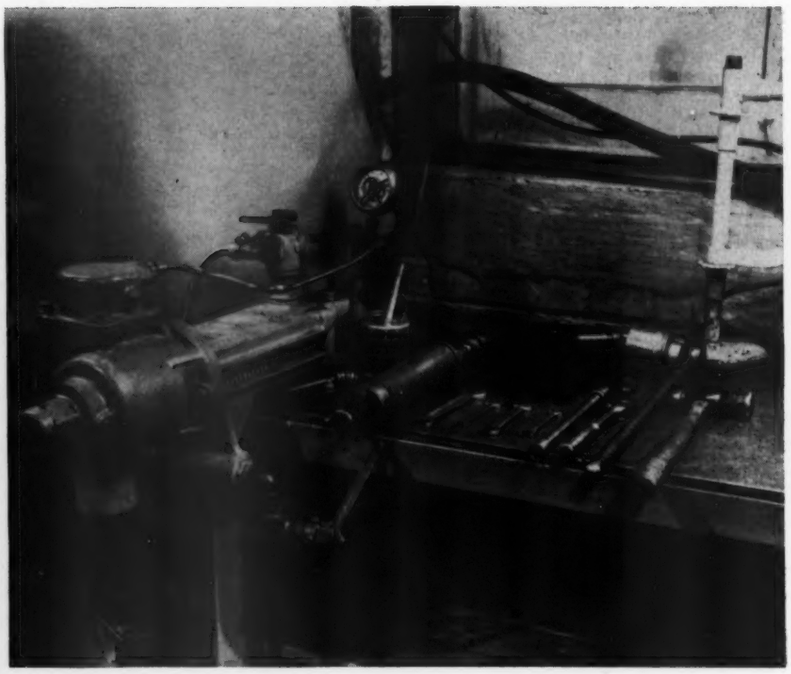


Fig. 7—After reassembly, an automatic slack adjuster is connected and completely tested at this station to make sure that operation and adjustment are correct

these devices depends to a considerable extent on the volume of air to be handled and the time required to release the shoes from the wheel. It is also desirable to keep the piston travel short and uniform throughout the train to insure uniform wear of brake shoes. This will materially increase the mileage life of shoes as compared with longer and uneven travel. Burlington practice is to adjust all piston travel to 2 in. on cars or diesel units with D-22 or D-24 schedule.

At the time of periodical air brake cleaning on passenger cars with truck mounted brake cylinders and on diesel units, the brake cylinder pistons with non-pressure heads and the automatic slack adjuster engines are removed and taken to the shop for cleaning, repairs and lubrication. Fig. 3 shows the bench, with tools and jig used in dismantling, repairing and assembling the piston and non-pressure head. With a tool for each operation, time consumed is held to a minimum—about 15 min.

Fig. 4 shows the assembly after the piston and spring have been backed out of the head. Fig. 5 shows the piston and sleeve mounted in a rotating jig, where the mechanic polishes the sleeve with emery cloth when necessary. Fig. 6 shows the automatic slack adjuster engine dismantled; all parts have been cleaned, inspected, repaired or renewed, ready for greasing and assembly.

Fig. 7 shows a repaired engine mounted on the test rack where its operation is carefully checked before being returned to service.

The trucks under all high speed cars and diesel units are removed and sent to the shop for general overhaul about each 24 months, or after about 650,000 miles of service. When trucks are in the shop for overhaul, all parts are restored to new dimensions.

To insure proper piston travel and brake lever adjustment, the mechanic must understand the function of each device used in adjusting the brake. On a typical high-speed four-wheel truck, the top pull rod is just beyond the brake cylinder. This rod has a three-hole jaw at one end and a hand operated screw adjuster at the other end. The three holes are provided to adjust the rod for the correct length when wheels are changed.

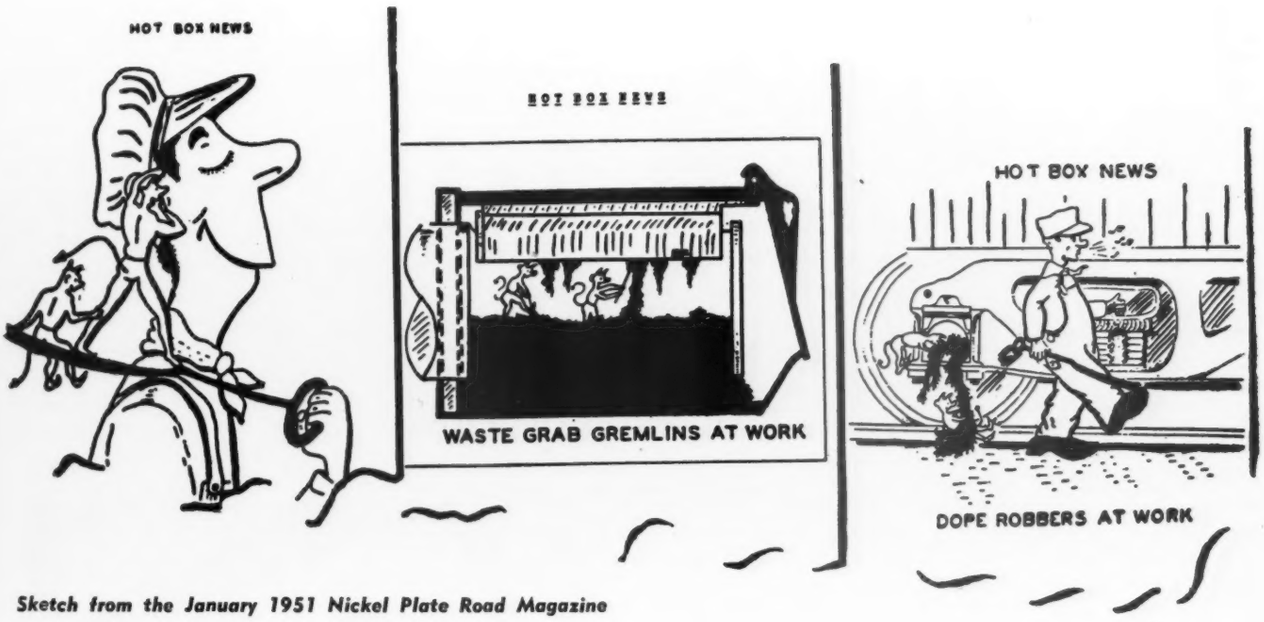
The hand adjuster is used to adjust for the desired piston travel when shoes are changed. The automatic slack adjuster shown near the brake cylinder is for the purpose of making adjustments to keep the piston travel at the desired value as shoe wear takes place while the train is in operation. It should be run back as near as possible to the starting position in order to obtain the greatest possible reserve travel, to compensate for wear.

When this re-setting of the automatic slack adjuster has been made, the manual slack adjuster should then be run in or out to produce the desired piston travel. If the travel of the manual screw adjuster is insufficient to compensate for wear or to bring the piston travel to the desired value, the additional range of compensation necessary is available by changing the pin adjuster at the other end of the rod.

On a typical six-wheel diesel truck similar adjustments are made to get correct piston travel. The details of the rigging are different but the principles are the same. There are two cylinders and two manual slack adjusters located below the axles instead of at the top of the rigging as in the four-wheel truck.

We have found beyond question that high quality brake maintenance is the most economical in the long run. It is possible to cut maintenance to the bone and do only the minimum required to keep the brake operative, but such practice will not promote economy or safety.

The elimination of loose and floppy rigging which rapidly wears out at high speed, will more than pay for itself in longer life and reduced repair bills. Accurate adjustment pays rich dividends in increased brake shoe life and in giving the engineer a precision brake which improves handling and makes overbraking unnecessary. Poor workmanship is always most expensive in the long run. The most economical way to do a job is to do it right.



Sketch from the January 1951 Nickel Plate Road Magazine

Ways to Prevent Hot Boxes

THE statistics on hot boxes on freight cars issued by the Association of American Railroads, Mechanical Division, monthly led to a discussion, at a recent meeting of the Anthracite Valley Car Foreman's Association, Scranton, Pa., of letters outlining practices instituted by four railroads having the best hot box performance. Some of these practices are:

- Increased yard and maintenance forces
- Arouse interest to prevent lack of attention
- Renew all dust guards when wheels are changed
- Incoming inspection of all journal boxes
- Adequate amount of packing in journal boxes
- Better truck maintenance
- Special attention at points where the business volume justifies
- Policing of operations
- Special assignment of lubrication engineers to supervise, educate and inspect lubrication activities.

It was brought out that different maintenance and operating practices no doubt influence the hot box mileage performance. For example, on some roads journals are rebrassed en route by train crews and since such cars are not set out they are not counted, whereas on most railroads, the cars developing hot boxes are set out.

Attention was called to axle journal damage caused by retainers in boxes on Andrews type trucks. The recommendation was made (by a committee) that retainers be removed from such boxes and further that railroads be restricted from applying retainers to any journal box where journal box bolts are used.

It was reported that considerable trouble has been experienced with end worn bearings due to the poor finish on inside of collars on new and reconditioned axles, which condition also has a tendency to disturb the journal box packing.

In the interest of education and promotion of efficiency, one member reported that on his railroad a system has been introduced whereby any employe engaged in box packing must first be qualified before undertaking such work. To that end he is properly instructed in the packing of boxes by a qualified supervisor and required to answer orally questions pertinent to the work. When qualified, a certificate to that effect is kept on file.

The following outline of procedure followed, which consists of oral and field examinations may be of interest:

Q.—What kind of packing is to be used when packing a journal box or when adding packing to a box when there is an insufficient amount in the box?

A.—New or reclaimed packing. Sec. 7, Para. A.

Q.—What condition should the journal box be in before starting to pack it?

A.—Thoroughly cleaned.

Q.—What is the first operation to be performed when packing a journal box?

A.—Hand made back roll properly applied. Sec. VII, Para. B.

Q.—How should the body of the packing be applied?

A.—One piece method. Sec. VII, Para. D.

Q.—How high should packing be on the sides of the journal?

A.—One inch below the center line of the journal along the sides. Sec. VII, Para. D.

Q.—Should the packing be firmly placed in box?

A.—Yes, firm enough to fill the space under the journal and bear evenly along the sides but not too tight to retard capillarity; i.e., the oil flow through the waste. Sec. VII, Para. C.

Q.—How much free oil should be in the journal box after packing?

A.—Approximately one inch. Sec. VII, Para. F.

Q.—When adding additional packing to a journal box when same is being treated, what procedure should be followed?

A.—Pull sufficient packing across the full width of the mouth of the box and allow strands to hang down outside. Add packing so it will have the effect of binding all of the body of the packing in one piece. Sec. VII, Para. D.

Q.—When packing boxes with and without retainers, what methods are to be used?

A.—(a) With retainers—Packing should be placed vertically down on the inside of collar. Fig. I-C.

(b) Without retainers—Packing should extend on a 45 deg. angle from underneath the inside of the collar. Fig. I-CI.

Form of Certificate

John Doe, box packer, has been duly examined and has qualified that he is thoroughly familiar with instructions and can properly treat and pack a journal box as outlined in the A.A.R. Lubrication Manual.

Car Kinks from the Indiana Harbor Belt

The service life of large stencils on the Indiana Harbor Belt has been increased from a maximum average of 50 cars to a consistent average of 380 cars. At the same time the more durable stencil does a far neater paint job by giving sharp solid painted lines with no unpainted spots and with no blurring around the edges. It further prevents destruction of the stencil from high winds.

These objectives are accomplished by wiring the different sections of the stencil together, rather than by joining them with small sections of the stencil paper left in place.

The wire is wound around nails and threaded in and out of the stencil paper every inch or two, except in small spaces, such as the "A" in the word "All" of the stencil shown in both of the illustrations. It enters the individual sections about ¾ in. from the edges so that the stencil paper will lie flat adjacent to the surface to be painted, and thereby aid in painting a sharp clear line. The wire is twisted across the openings between the sections to prevent relative movement between any of the sections. Two small strips of wood are fastened to the large center section for added rigidity.

Close-up of the wiring method to strengthen stencils, showing how the wire is twisted across the openings between the sections to hold them securely in proper relative position

Handy Way to Move and Spot Trucks

The Gibson, Ind., shops moves and simultaneously spots the two trucks under a diesel locomotive by means of two slightly different connecting bars. One bar connects the switching locomotive to one of the trucks, and the second connects the trucks together. The latter bar is of such a length, varying between different locomotives, that, when applied between the trucks, the correct center-to-center distance between the trucks is automatically attained. Spotting is further facilitated by the rigid connections, with no slack of both of the bars.

The bar that extends between the trucks joins to each

Wiring the sections of this stencil together has increased the service life eight times, eliminated damage from high winds, and given neater paint jobs

Trucks are both moved and spotted the proper distance apart under the locomotive by this spacing bar

The bottom of the U-shape end is hinged to simplify application of the bar to the trucks when the trucks are under the locomotive

truck through a U-shaped end hinged at the bottom. This hinging simplifies application of the bar when the trucks are under the locomotive; the bar can be laid in place, the bottom leg of the end raised to position, and the fastening completed by screwing the bolt into the nut welded on the top leg.

The bar that connects one of the trucks to the locomotive is similar, except that the U-shaped end which fastens to the locomotive is in one piece, not hinged. It connects to the locomotive by removing the coupler knuckle, and dropping the knuckle pin through the openings in the end of the bar.

Four Helps in Reclaiming Brasses

The four illustrations show some of the devices which the Missouri Pacific has found helpful in reclaiming journal brasses at Sedalia, Mo.

Fig. 1 shows a machine that is equally useful for the roughing out cut before rebabbitting or for the finishing cut after rebabbitting. In the first operation, the large face miller faces one end; then the journal is bored, and finally the other end is faced. The face millers for the ends are form cutters which cut to the correct length and to the proper radius. The machine has high uninterrupted production because it is loaded and unloaded from the foreground station at the same time that it is cutting at the rear station.

The machine in Fig. 2 for grinding the faces has a similar high production rate because it too is loaded and unloaded at the same time that it is doing its work. The table turns continuously during grinding, which is done by sectional stones. The brasses are clamped in place by the hinged levers, which lock under the ears on the table.

Fig. 3 shows a water-cooled mandrel for pouring the babbitt. The brass is quickly secured in place for pouring by the U-shaped spring clamp on top and by the bent bar on the side.

The layout for melting the old babbitt off the brasses is illustrated by Fig. 4. The brasses are put in at the left and are moved along the grate by a pusher driven by an electric motor through reduction gearing which moves the grates three times per minute. The molten babbitt

Fig. 1—This machine is loaded and unloaded at the same time the brasses are bored and faced.

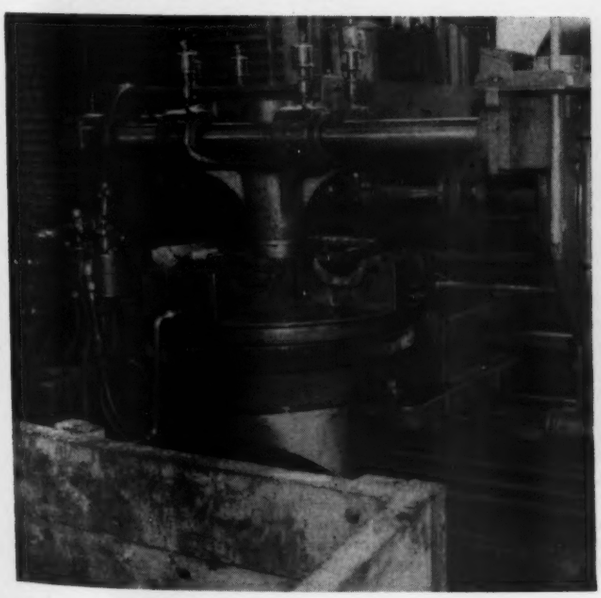


Fig. 2—Machine for uninterrupted grinding of the journal brass faces

▲ Fig. 4—Layout for melting the old babbitt

◀ Fig. 3—Water-cooled mandrel with quick clamping arrangement for pouring the brasses

falls through the grates and is poured into the pigs from the spout a little to the right of the oven center. The brasses continue on, falling off the grates into the skid at the extreme right.

* * *

The first of 65 new all-plywood Unicel freight cars, purchased by the Arabian-American Oil Company for use on the new railroad which they are building in Saudi Arabia, rolls off the production line at Pressed Steel Car Company's plant at Hegewisch, Ill. Inspecting the car, and puzzling over the Arabic script (which reads, from right to left "Arabian-American Oil Company. 3100") are, left to right, F. Dale Campbell of Pressed Steel Car Company's export division; John J. Riordan, engineer for Arabian-American Oil Company; W. F. Wilmas, executive vice-president of Pressed Steel Car Company; Henry A. Ford of R. W. Hunt Company; and Bertrand Goldberg, designer of the Unicel car.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Turbosupercharger

317-Q.—What is the function of the turbosupercharger? A.—To provide supercharging of the diesel engine, all cylinders are charged with air above atmospheric pressure.

318-Q.—What is the advantage of supercharging? A.—The added air in each cylinder permits more fuel to be burned than would be the case if the cylinders were charged with atmospheric pressure only.

319-Q.—What comprises the turbosupercharger? A.—An exhaust gas powered turbine and a centrifugal air compressor mounted on a common rotor shaft.

320-Q.—Where does the power come from that operates the turbosupercharger? A.—Energy in the exhaust gas from the engine is recovered in the gas turbine to drive the centrifugal blower supplying air at supercharging pressure.

321-Q.—What eventually becomes of the exhaust gases? A.—The gases pass through the turbine on out through the gas outlet and expelled to atmosphere by means of an exhaust stack through the locomotive roof.

322-Q.—Approximately how much air pressure is developed? A.—Eighteen to twenty pounds.

323-Q.—How does the air get to the cylinders? A.—The air is drawn through a filter silencer by the compressor and is compressed after which it is directed through the air manifold to the engine cylinders.

324-Q.—What happens as the air enters the cylinders? A.—The air entering the cylinders, first scavenges the burnt gases and then charges the cylinders with clean air under pressure.

325-Q.—How is the air intake manifold formed? A.—By enclosing the *V* in the engine frame with sectional covers. Elbows, cast integral with these covers, conduct air to the individual cylinder heads. An expansion joint and elbow connect the compressor side of the turbosupercharger to the air manifold.

326-Q.—Describe the air intake filter and silencer. A.—The air intake filters and silencer assembled as a unit are bolted to the turbosupercharger air intake elbow and supported by a bracket from the locomotive roof.

327-Q.—How does the silencer perform its function? A.—By means of baffles and sound deadening material the air intake silencer muffles the noise created by the air rushing into the turbo supercharger.

Fuel Oil System

328-Q.—Where is the fuel supply tank located? A.—Beneath the underframe between the trucks.

329-Q.—What is the fuel tank capacity? A.—1,200 gal. on the road locomotive and 800 gal. on the road switcher.

330-Q.—With what are the tanks equipped? A.—(1) A sight glass gage to permit observation of the fuel level on the side of the tank; (2) Two vent pipes with flame arrestors; (3) Drain plugs for washout purposes and also a drain valve.

331-Q.—What type drain valve is used? A.—An inverted type held in place by a cap nut.

332-Q.—Describe the operation when draining the tank. A.—Remove the pipe plug in the side of the cap nut and then loosen the cap nut a few turns. This will allow the valve to drop from its seat and condensation drains through the hole in the cap nut. Tighten the cap nut and apply pipe plug.

333-Q.—What additional fuel level indicator is provided on the road locomotive? A.—Road locomotives are equipped with a remote gage which indicates the fuel level in the tank in gallons and inches and operates on 10 lbs. air pressure.

334-Q.—What precaution must be taken with the air supply valve? A.—It must be kept closed except when taking a reading.

335-Q.—Why is this necessary? In order to maintain gage accuracy and to prevent condensation from getting into the fuel tank.

336-Q.—What draws the fuel from the fuel supply tank? A.—An electric motor driven fuel oil booster pump.

337-Q.—What part of the fuel system is between the tank and booster pump? A.—It is known as the suction side.

338-Q.—When the oil leaves the tank, what must it pass through before it gets to the bottom pump? A.—All oil drawn from the tank must pass through the emergency fuel cut-off and fuel oil suction filter.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives.

Steam Locomotive Practice

By George M. Davis

Draft Gear Inspection Rules

Q.—Are the rules governing the maintenance and inspection of the drawbar connections between engine and tender of a steam locomotive applicable to the drawbar connections between the two units of a diesel locomotive?—M.F.R.

A.—The drawgear between the locomotive and tender, together with the pins and fastenings, shall be maintained in safe and suitable condition for service. The pins and drawbar shall be removed and carefully examined for defects not less frequently than once each three months. Suitable means for securing the drawbar pins in place shall be provided. Inverted drawbar pins shall be held in place by plate or stirrup, while drawbars and pins when used between units of diesel locomotives shall be removed

as often as conditions may require, but not less frequently than once every six months. When drawbars and pins are removed, they and their connections shall be carefully inspected for defects. Date of last removal and inspection shall be legibly stamped on the head of the pins and drawbars and all prior dates obliterated. Provisions shall be made for securing drawbar pins in place, and a plate or stirrup shall be provided under the lower end of all drawbar pins which will prevent the pin from falling out of place in case of breakage.

Alloy Steel in Rods

Q.—What are the advantages of using molybdenum steel for locomotive main and side rods?—P.F.R.

A.—Molybdenum steels used for locomotive main rods and side rods have sufficient hardenability to develop high fatigue resistance and improved service life under conditions of railroad service. One of the most important effects of molybdenum is its ability to reduce the effect of mass on the mechanical properties developed by heat treatment and to give fairly uniform properties even in very large sections. Molybdenum not only improves the room temperature properties but also strength at higher temperatures and the toughness at lower temperatures. Molybdenum steels with superior combinations of strength and toughness are used for lightweight reciprocating parts.

Molybdenum decreases the susceptibility of steels to temper brittleness resulting from heat treatment. Use of the proper amount of molybdenum, in a steel which would otherwise be embrittled by tempering in the range 850 to 1,100 deg. F. or cooling slowly through this range from a normalizing or annealing temperature, is a practical and economical way to avoid temper brittleness and improve the toughness and fatigue resistance of heat treated alloy steel forgings.

The mechanical properties of typical molybdenum steels used for main and side rods, normalized, quenched and tempered are as follows:

Tensile strength, p.s.i.	102,000
Yield point, p.s.i.	91,000
Elongation in two inches, percent	26
Reduction of area, percent	68
Tensile strength, p.s.i.	132,000
Yield point, p.s.i.	115,000
Elongation in two inches, percent	22
Reduction of area, percent	65

Cylinder Clearance

Q.—How is the cylinder clearance of a locomotive determined? What is meant by a six per cent cylinder clearance?—F.E.D.

A.—Cylinder clearance on a steam locomotive is the space between the piston, when at either extreme position, and the cylinder head. It includes all space bounded by these members, inside of the cylinder walls. It is measured by volume and is designated by its percentage to the total cylinder volume. A six per cent cylinder clearance means the volume of the space between the piston head, in extreme position, and the cylinder head is six per cent of the volume of the cylinder obtained by multiplying the area of the piston by its stroke.

Weight Distribution

Q.—Does the removal of the booster have any great effect on the weight distribution of a steam locomotive?—R.E.A.

A.—On a conventional modern 4-8-2 type freight locomotive having the booster removed from the trailer axle, and all other booster equipment and piping removed from the locomotive will result in the loss of spring borne weight of approximately 8,200 lb., with the center of gravity of the spring borne weight of the locomotive moving forward approximately five inches increasing the weight on the engine truck and reducing the weight on drivers. The general practice is to move the trailer equalizer pin forward a sufficient amount so that the weight on drivers will remain the same for the non-booster locomotive as it was on the booster equipped locomotive which results in the weight on the rear trailer wheels being reduced approximately the amount of weight of the booster equipment removed; with but little change to the weight on the engine truck. A typical example as to the effect the removal of the booster has on the weight distribution of a 4-8-2 locomotive is as follows:

	Engine Truck, lb.	Weight on Drivers, lb.	Trailer Truck, lb.
Booster Equipped Locomotive	65,400	257,000	62,700
Non-Booster Equipped Locomotive—No change in Spring Rigging	69,800	247,100	59,000
Non-Booster Equipped Locomotive — Trailer Equalizer Pin moved four inches ahead (one hole)	63,800	258,700	53,400

Steam Locomotive Boilers

By George M. Davies

Should Holes Be Plugged?

Q.—When relocating the feed water pump boiler check from the side to the top of the boiler, is it satisfactory to plug the hole in the shell with a standard brass boiler plug?—M.E.K.

A.—As all openings over 3¼ in. in diameter and or exceeding 4½ times the thickness of the plate must be suitably reinforced and all screw plugs must have at least four full threads in the sheet which would no doubt require the application of a reinforcement plate at the check hole. It would be more practical to apply a suitable diamond shaped patch to permanently close the hole when relocating boiler check from side to top of boiler.

Forming a 40-in. Dome

Q.—When flanging a one-piece dome for a locomotive boiler using conventional ring and plunger dies, how many heats will be required to form a dome 40 in. diameter, and 12 in. high, using 1¼ in. thick plate?—V.M.F.

A.—The general practice is to use two heats of the material for domes up to a height of 12 in. high and three heats up to a height of 19 in. Beyond these heights the number of heats will vary from 5 to 7 up to a height of 30 in. This does not include the flanging of the dome base to the contour of the boiler shell.

Steam Generator Safety Valve

Q.—Is there any law or regulation which requires that the Safety Valve which is applied to the Steam Generator on diesel locomotives must have a lever?—R.G.M.

A.—Steam generators furnished by the diesel builders are built to the A.S.M.E. Code, the name plate on the generator is stamped with the A.S.M.E. Symbol and National Board or Hartford Steam Boiler Number assigned.

The A.S.M.E. code provides as follows:

Par.-282—"To insure the valve being free, each safety valve shall have a substantial lifting device by which the valve disk may be positively lifted from its seat when

there is at least 75 per cent of full working pressure on the boiler. The lifting device shall be such that it cannot lock or hold the valve disk in lifted position when the exterior lifting force is released."

The handles are applied to the safety valves to conform to this requirement of the A.S.M.E. Code.

The I.C.C. Bureau of Locomotive Inspection, Laws, Rules and Instructions for Inspection and Testing of Steam Locomotives and Tenders, for other than Steam Locomotives provides as follows: 316(a) "Every steam boiler shall be equipped with at least two safety valves and every hot water boiler shall be equipped with at least one water relief valve, the capacity of which shall be sufficient to prevent, under any condition of service, an accumulation of pressure of more than 5 pounds above the allowed working pressure. The safety valves shall be connected with the boiler independent of any other connection, and located as closely to the boiler as may be consistent without discharge inside of cab. Water relief valves may be mounted on the expansion tank of hot water boilers provided no valves are interposed between the expansion tank and the boiler. Sufficient clearance to prevent damage shall be provided where safety or relief valves or connections pass through cab structure."

The I.C.C. rules make no mention of the use of a substantial lifting device or handle to insure that the safety valves are free, however, it would appear that these appurtenances should be maintained in accordance with the A.S.M.E. Code to conform the stamping on the steam generators.

Any change in the number, size, make and style of safety valves as shown in the original specification, filed with the I.C.C. must be reported by filing an alteration report.

Inside Shell Patches

Q.—What are the objections to applying a patch on the inside of the shell, when the locomotive is in for classified repairs with the tubes and flues removed?—F.E.L.

A.—Patches should not be applied to the inside of the shell to cover defects such as corrosion as the patch would cover the corroded area and thus prevent future inspection of the corroded area, without removing the patch, Also, patches applied to the inside of the shell to reinforce cracks would not permit caulking along the edge of the patch, in the event of a leak, without removing the tubes and flues.

Schedule 24 RL Air Brakes

Train Control Operation

1201-Q.—When operating the electro-pneumatic brake, how is a temporary suppression obtained?

A.—By making a moderate application.

1202-Q.—Explain the flow of air to cause a temporary suppression.

A.—Air from the straight air pipe enters the A-1 suppression valve at connection *28* and flows against double check valve *16* and into passage chamber *A* to close cut-off valve *80* and cause a temporary suppression.

1203-Q.—What other flow of air from the straight air pipe occurs?

A.—Air from the straight air pipe also flows through choke *44* under return diaphragm *49* to passage *37* and straight air suppression timing reservoir.

1204-Q.—What will eventually result from this flow of air?

A.—A train control application will occur unless a heavier straight air application is made.

1205-Q.—What will bring about a train control application in the event that a heavier application has not been made?

A.—Pressure will increase in chamber *E*, diaphragm *49*, and in a predetermined time will overcome forces holding cut-off valve *80* closed, and permit it to re-open causing a train control application.

1206-Q.—How much air is required in the straight air pipe in order to bring about a permanent suppression?

A.—About 45 lbs.

1207-Q.—How is a permanent suppression obtained?

A.—Pressures in chambers *E* and *A* will cause a collapse of suppression spring *29* and the area of diaphragm *57* being greater than diaphragm *49*, will hold the assembly to the right and cut-off valve *80* remains closed.

Changing Ends (Two Diesel A Power Units)

1208-Q.—When changing ends on double end "A" equipment (Two A Units), what must first be done?

A—Make a 20-lb. brake pipe reduction with the automatic brake valve and place it in Lap position.

1209-Q.—What next should be done?

A.—Move the independent brake valve handle to release position and observe if the brakes are still applied.

1210-Q.—What action should then be taken?

A.—Close the brake pipe cut-out cock place K-2 rotair valve in Lap position or the K 2-A rotair valve in "FRGT" or "PASS" Lap. Move automatic brake valve handle to Running position and remove both handles.

1211-Q.—What is done to assume control at the other end?

A.—First, insert the brake valve handles, place rotair valve on "PASS" position, move independent brake valve handle to application position. Open the brake pipe cutout cock and move the automatic brake valve handle to emergency position and then back to Lap.

1212-Q.—When changing pressures, what should be done to avoid the possibility of an overcharge?

A.—Depress the independent brake valve handle in full application position for about eight seconds.

1213-Q.—What is finally done to assume control?

A.—Move automatic brake valve handle to running or release position. Position rotair valve for service desired (either "PASS" or "FRGT"), depress foot pedal, check gages to insure brake pipe and main reservoirs are fully charged, then release independent brake.

Hauling Locomotive A Unit Dead in Train

1214-Q.—What preparation should be made at the brake valve for an A unit to be hauled dead in a train?

A.—Close the brake pipe cut-out cock and remove the brake valve handle (in running position). Move shifter lever if included to A.U. position.

1215-Q.—What other changes should be made?

A.—Open the dead engine cock (or change the dead engine cap).

1216-Q.—Where is the dead engine cap located?

A.—On the control valve pipe bracket just above the service portion.

1217-Q.—What does this provide for?

A.—Provides for charging the main reservoir from the brake pipe.

1218-Q.—What should finally be done?

A.—Open the brake pipe branch pipe cock to charge the D-24 control valve reservoirs. Remove or keep the independent brake valve handle in release position. Position rotair valve in passenger (PASS) position.

ELECTRICAL SECTION

Freon Compressor for Air-Conditioning Maintenance

Charging and evacuating air-conditioning systems is facilitated by portable unit developed in Los Angeles General Shops of the Southern Pacific

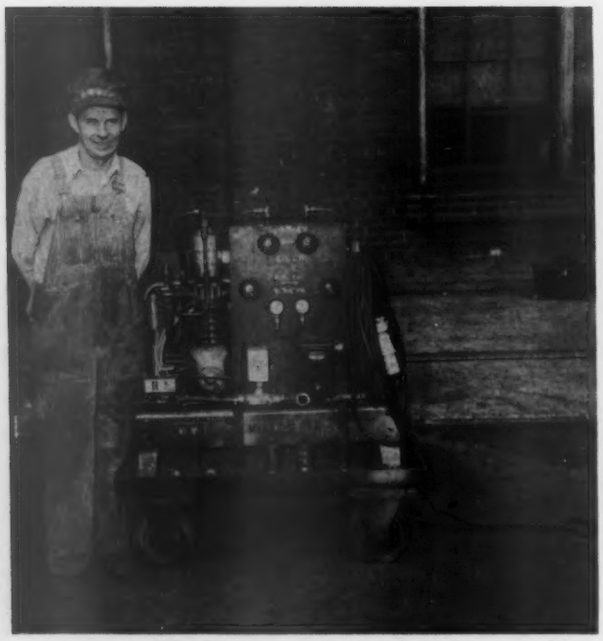
*By Walter Kaysen**

THE PORTABLE unit shown in the illustrations includes a motor-driven compressor, condenser, dehydrator, trap and the valves and piping necessary to use it both for charging and evacuating freon gas used in air-conditioning systems. It was developed by the author, under the supervision of A. E. Lines, departmental foreman of electricians.

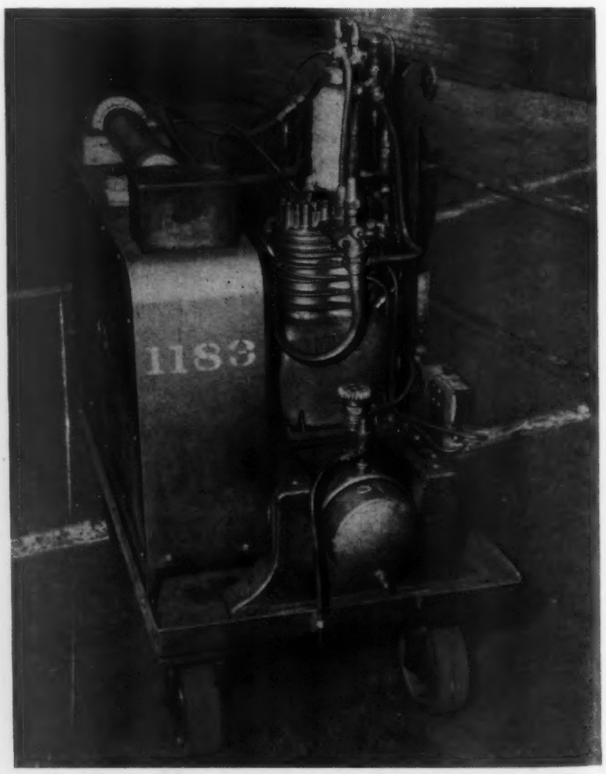
To pump down a car unit, the hose *H* (see diagram), is connected to an empty refrigerant tank. The hose *I* is connected to the high side of the compressor unit to be pumped down. If the unit has been removed from the car, the hose is connected to the high-side car connector with a quick-detachable adapter. For pumping gas from the car after the air conditioning unit has been removed, the portable compressor is connected to the high side with the proper adapter.

The procedure is as follows: Open the two valves at the top of the control panel. These are the valves marked *C* and *D* in the diagram. Open the valves *T1* and *T2* on

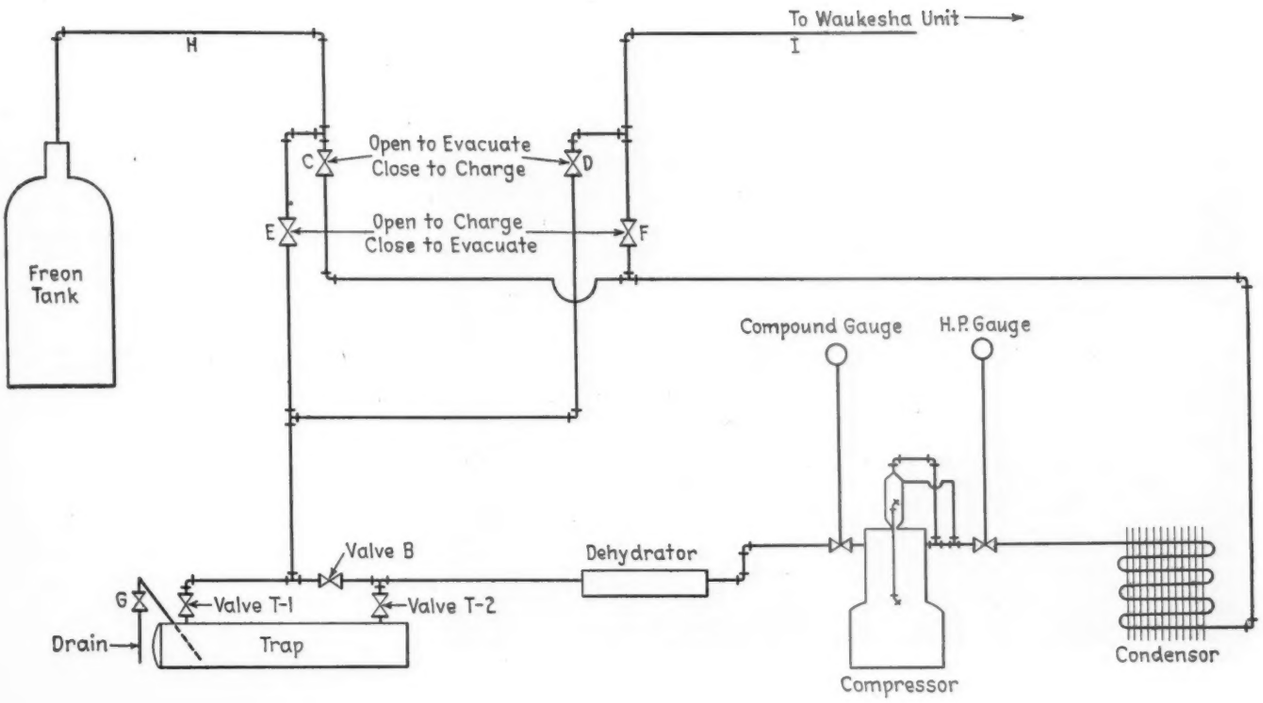
* Electrician, Los Angeles General Shops, Southern Pacific Company, Los Angeles, Cal.



The portable unit and the author



An end of the unit showing the trap in the foreground.—The dehydrator is at the upper left and the motor and V-belt drive is in the screened housing at the left



Schematic piping diagram

the oil trap tank. Close valve *B*. Then close the two lower valves on the upper panel. These are the valves *E* and *F* on the diagram. Open the high-side valve on the unit being pumped down. Bleed off air to the refrigerant tank. Open the tank valve. Start the compressor on the portable unit by means of the manual switch. If the attendant must leave the unit before the operation is complete, place the switch in the automatic position.

After the air conditioning unit or car has been pumped down, and everything disconnected, open the valve G on the oil trap tank and blow out any oil or dirt which may have accumulated. This oil trap tank is not being used as a receiver in the normal way, but rather as an oil and dirt trap.

To charge a unit on a car, the procedure is as follows: Connect the portable unit to the compressor on the car as in the case of pumping-down. Arrange valves as for pumping-down. Leave the tank hose disconnected and run the portable compressor until the air has been evacuated from the system which is to be charged. Run until a good vacuum is established and no air comes from the hose.

Connect the hose to the refrigerant tank and close the two upper valves, *C* and *D*. Open the two lower valves, *E* and *F*, and also open the valve *B*. Close the valves, *T1* and *T2*, and start the compressor on the portable unit, either on manual or automatic.

Lay the refrigerant tank down on its side. After 10 or 15 lb. pressure is built up in the system, stop the compressor. Test the car system for leaks with Halide lamp in the usual manner, and proceed with charging after repairing leaks if necessary.

The portable unit filters the refrigerant as it is removed from the car and only clean refrigerant is stored in the tank. While a system is being charged, the filter trap is by-passed. The Silica Gel in the dehydrator should be changed occasionally.

When a system is being charged and leaks are found, the refrigerant in the system can be removed by arranging the valves for this purpose. This can be done without changing the hose hook-up.

The pressure switch on the pump unit is set to shut off at 0 lb. pressure and to start at 10 lb. pressure. If the high-side pressure builds up to 190 lb., the compressor will stop.

The small tank mounted on top of the compressor is an oil trap which protects the compressor from losing its charge of oil. On top of the trap is a filter of Poronze which should be cleaned occasionally.

Round and round he goes, and when he stops, this inspector will have completed examining a line-up of synchronous motor stator frames at General Electric's Large Motor and Generator department, Schenectady, N. Y. Rated 100 hp. to 500 hp., these motors will be used to drive pumps, compressors, hoists, conveyors, generators, fans and other equipment

Tester for G. E. Engine Governors

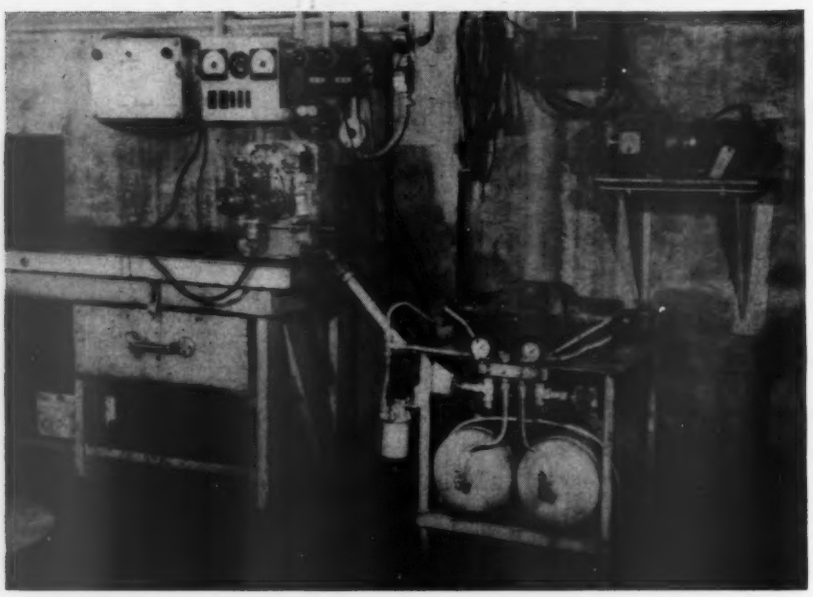


Fig. 1—General view of the governor testing equipment

Testing equipment for General Electric diesel locomotive engine governors developed in the Marion, Ohio shops of the Erie is shown in the three illustrations.

The governor to be tested is placed on the bench as shown in Figs. 1 and 2. The oil pressure required for governor operation is supplied by the motor-driven pump shown on the stand at the right of the bench in Fig. 1. This is the same type of pump used on the locomotive.

A cable and plug connection like that on the locomotive (see Fig. 2), is used to connect the governor electrical circuits to the test panels above the bench. Figure 3 shows these panels in detail.

The meters on the right-hand panel are respectively an 0-500 d.c. milliameter, an 0-100 d.c. voltmeter, and an 0-100 d.c. ammeter. Power for testing is furnished by a motor-generator set. This power operates the motor which drives the oil pump and the voltage as shown by the voltmeter is maintained at 72. On the left-hand (test) panel are various adjustable and fixed resistances for making various tests.

The speed pilot valve is shown at the upper right corner of the governor. This is tested by means of the adjustable rheostat shown in the upper left corner of the test panel. This rheostat is used to adjust the resistance in the speed pilot valve circuit to a point at which

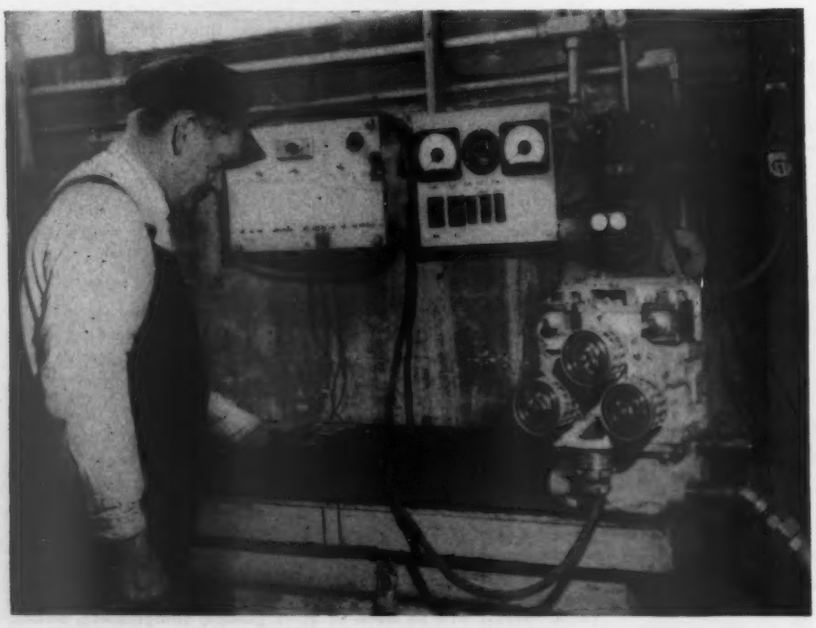


Fig. 2—H. Dixon who developed the testing equipment making resistance tests with a Simpson battery-powered ohmmeter

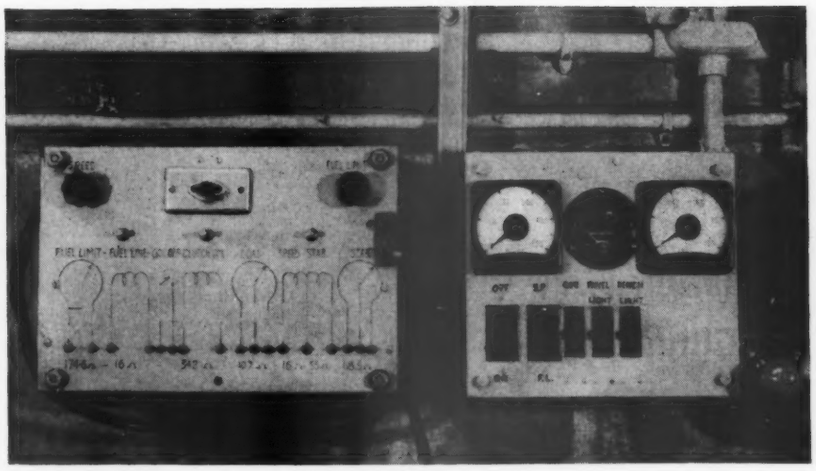


Fig. 3—The test panel at the left and meter panel at the right

the pilot valve is balanced. This will occur when the milliameter shows .475 amp. if the valve spring tension is correct.

The fuel limit valve (upper left on the governor) is tested in the same manner by means of the rheostat in the upper right-hand corner of the test panel.

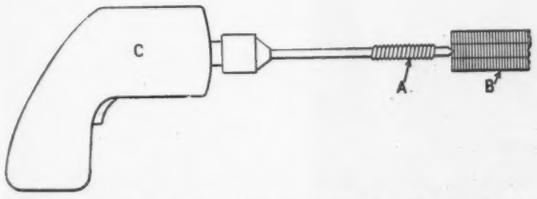
The push button in the upper center of the test panel energizes the stabilizing coil in the speed pilot valve, and admits oil to the slave piston which brings the *A* an *B* arms of the governor together. Toggle switches at the left and right are in the corresponding rheostat circuits.

The lower connections on the test panel under the diagrams are connections for a battery-operated ohmmeter. With the ohmmeter connected across the respective terminals, it is used to measure the resistance of coils and potentiometers. The readings which the ohmmeter should show if all resistances are correct are shown between each pair of terminals. Reading from left to right, they are as follows:

Fuel limit potentiometer	174	ohms
Coil of fuel limit pilot valve	16	ohms
Clutch coil	342	ohms
Load potentiometer	10.7	ohms
Speed coil of speed pilot valve	16	ohms
Stabilizing coil in speed pilot valve	55	ohms
Stabilizing potentiometer	118	ohms

Cleaning Armature Slots

The best way to clean armature core slots before rewinding is by means of a flexible steel rod about eight in. long, which has a serving of coarse string on it. This is shown in the sketch. This is mounted in, and rotated by an electric drill. The advantage of this method of cleaning is that no metal dust is produced and it is impossible to burr the laminations over. Improper cleaning of the slots before rewinding often causes core heating due to eddy currents. The cause of this is conducting dust being left in the slots or the laminations burned over. It is often found that armatures run hotter after a rewind.



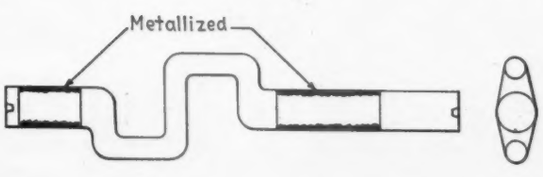
A is a serving of coarse string on a rod in the chuck of the electric drill (C) as used to clean core slots

W. E. Warner
Woodford Green, Essex, England

Armature Press Repaired With Metal Spray

By Michael Axler

We have a 40-ton press that we use for applying or removing shafts, commutators and laminations on our traction motors. After years of service, the shaft and the main crankshaft bearings of the press pump became so worn that it interfered with operation of the press. It was easy to close in and scrape the bearings, but the shaft was a problem.



No parts were available since the press was over 30 years old. A new shaft could be made at a price of $241.00, but it could not be delivered within three months, and something had to be done at once.

The shaft is 5 ft. long, 5 in. in diameter, and has two throws. It is made of gray iron and preheating would probably cause warping. Brazing was also not practicable.

It was finally decided that it could be restored by metallizing. The worn sections were first turned with a 60-deg. thread cutting tool with 16 threads per inch.

This operation was performed in 15 minutes, after which the worn sections were metallized with bronze wire, this operation requiring 1 hr. and 23 min. The shaft was then turned to size in 22 min., making 2 hr. for the complete job. The total cost, including labor, metal used, and overhead was $13.50 The most important factor was that the press was idle only a few hours.

Insulating Field Coils By Filling Frame

About two years ago, the Great Northern developed a device by means of which traction motor field coils are insulated by filling the motor frame with insulating varnish. Experience has proved the method to be satisfactory and its use will be extended.

The device, as shown in the illustrations, incorporates a rectangular varnish tank, most of which is below the floor level. Projecting from the top of the tank is a cylinder or plug which has the same diameter as an armature. The purpose of this cylinder is to reduce the amount of varnish used to fill the frame.

When a set of coils are to be insulated, the frame is lowered down over the cylinder as shown in Fig. 1. Around the base of the cylinder is a neoprene gasket which fits tightly against the baffle between the field coils and the pinion-end bore when the frame is lowered to the position shown in Fig. 2.

The motor-driven pump shown in front of the device is then used to pump varnish from the rectangular storage tank into the space around the coils between the cylinder and the frame. Sterling R651 varnish is used for this purpose. It is pumped up until it fills the frame, and is allowed to remain for an hour or until all bubbling stops. A drain valve, operated from the top of the cylinder is then used to open a drain at the lower edge of the cylinder, and allow the varnish to drain back into the tank. Drain holes in the top surface of the tank allow any varnish which gets past the gasket to drain back into the tank.

Fig. 1—A field frame being lowered into place for insulating

An overflow near the top of the cylinder protects against overfilling. Such varnish as may leak past the neoprene gasket, and adhere to the frame, is removed from machined fits with varnish remover.

It is now done with D7 and D17 frames, and a new adapter and seal will be made for D27 motors. Another machine is planned for generator frames.

Fig. 2—With the frame resting on the seal, the operator starts the varnish pump

DIESEL-ELECTRICS—How to Keep 'Em Rolling

4 Running Maintenance of Commutators*

Resurfacing of a commutators requires know-how in order to insure good commutation and long life

"Face-Lifting" or Resurfacing

Commutator troubles may often be corrected by resurfacing. This is the name given to any process which restores a true, cylindrical, polished surface to the commutator.

Polishing.—If the commutator surface is merely smudged, you can clean it by polishing with canvas. When this is not sufficient, crocus cloth or fine (No. 4/0) sandpaper may be used. This should be mounted on a block curved to fit the surface of the commutator.

Stoning.—When only a small amount of copper has to be removed to correct the defect, a hand stone is most suitable. It should have a surface curved to fit the commutator. Also, it should be long enough to bridge the defect to be removed. Otherwise, the stone rides in and

* This is Part II of the 4th of a series of articles on maintenance of diesel-electrical equipment. This article is written by J. W. Teker and J. R. Schrecongost, both of the Motor Engineering Division, General Electric Company, Erie, Pa. Part I on the subject of commutator maintenance appears in the October, 1951 issue of *Railway Mechanical and Electrical Engineer*.

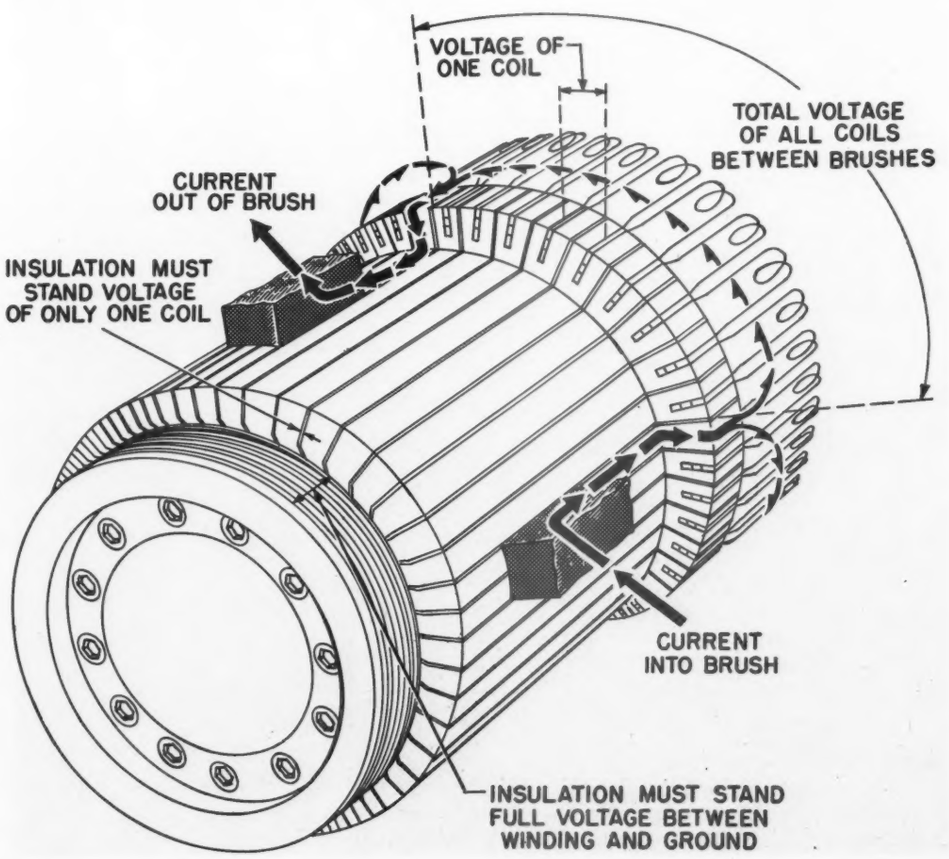

VOLTAGE OF ONE COIL
TOTAL VOLTAGE OF ALL COILS BETWEEN BRUSHES
CURRENT OUT OF BRUSH
INSULATION MUST STAND VOLTAGE OF ONLY ONE COIL
CURRENT INTO BRUSH
INSULATION MUST STAND FULL VOLTAGE BETWEEN WINDING AND GROUND

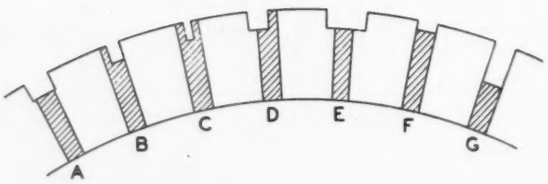
Fig. 2—The commutator must act as a reversing switch changing the alternating currents developed in the armature to the direct current in the exterior circuits

out of the defect and does nothing to correct it. The length of the stone will usually be limited by the space between brush holders. If this is not enough, a holder should be removed to make room for a larger stone.

When a greater amount of copper is to be removed, or the defect is too large to be bridged by the stone; use a jig, mounted on the frame of the machine to hold the stone. This jig has a movable carriage for passing the stone back and forth across the commutator. A feeding device regulates the position of the stone so that it cuts down the high spots on the surface. Jig stoning is faster and requires less skill than hand stoning. It also has the advantage that it will correct a commutator that is eccentric or out of round.

Turning.—If a commutator is badly worn or burned, the resurfacing operation can be speeded up by turning. A tungsten-carbide tipped lathe tool should be used because the speed may burn a tool-steel tip. Remove only enough copper to give a uniform surface. This cut should be followed by a coarse stoning and then a finish polish.

At times it may be necessary to remove the armature and turn the commutator in a lathe. When this is done, the armature should be supported on its own bearings if possible. If it cannot be supported on its own bearings, it must be held in lathe centers, but make sure they are



A. MICA PROPERLY UNDERCUT.
B. UNDERCUTTING TOOL TOO NARROW, LEAVING FIN AT ONE SIDE OF SLOT.
C. UNDERCUTTING TOOL VERY NARROW, LEAVING FINS AT BOTH SIDES OF SLOT.
D. SLOT IMPROPERLY INDEXED, PART OF BAR CUT AWAY AND FIN OF MICA LEFT.
E. TOOL TOO WIDE, PART OF BAR CUT AWAY ALSO.
F. UNDERCUTTING TOO SHALLOW, SHORTENS SERVICE LIFE BEFORE NEXT UNDERCUTTING.
G. UNDERCUTTING TOO DEEP, POCKET COLLECTS CARBON AND COPPER DUST, SHORT-CIRCUITING BARS.

Fig. 8—Some common mistakes in undercutting the mica between the commutator bars

Fig. 9—An example of how molten solder has allowed the leads to shift and has short-circuited the armature coils by collecting under the insulation

true with respect to the bearing seats—otherwise you will end up with an eccentric commutator.

Undercutting.—After a commutator has been resurfaced, check the depth of the undercutting of the mica between bars. If undercutting is necessary, it should be carefully done with the proper tool. Some common mistakes are shown on Fig. 8. Be careful to avoid these. Make sure that no fins of mica project as shown in Fig. 8B, C or D. They will spoil the brush contact on an otherwise good surface.

Air Curing.—Resurfacing usually leaves particles and slivers of copper hanging on the bar edges or lodged in the undercut. These must be removed before the machine is placed in service. Otherwise, they may shift and bridge the side mica, causing a flashover. A special tool or a stiff brush may be used for this job.

After raking and brushing out between bars, the job should be checked by operating the machine at no load. Start out with a low voltage. Sweep a strong jet of compressed air back and forth across the commutator surface midway between the brush holders. The voltage and the air stream act together to disturb and burn loose any copper particles remaining in the slots, and to blow them out. When sparking under the air jet stops, increase the voltage another step. Repeat until top voltage is reached.

This process is called air curing. It can be done easily with a generator by blocking open the power contactors and increasing the speed a notch at a time.

In order to check a motor commutator at full voltage, you must arrange to have the field separately excited. This is necessary to keep the motor from running away at no load and full voltage.

Safety Precautions.—When working on commutators, always wear goggles and gloves as a protection against flying particles, and possible flashover when air curing. A respirator also should be worn during stoning operations to avoid breathing abrasive dust.

Stoning a commutator with the brushes in place will wear them away very rapidly and cause carbon dust deposits on insulation. When working on an engine-driven generator, the brushes that are hard to reach should be removed before the engine is started. After cranking, the rest of the brushes should be taken out. In the case of motors, the good brushes should be removed, and worn ones substituted. Usually one brush in each holder is enough to run the motor light.

Brush holders.—After resurfacing a commutator you should check the height of the brush holders above its surface. If much copper has been removed, you may have to lower them to meet the new surface level. When the holders are too high, the brushes will be cramped and cause trouble by sticking.

Switching Duty or Commutation

We have already seen that the second duty of a commutator is to act as a reversing switch. Just as mechanical defects in the commutator surface interfere with proper brush contact, so electrical defects in the machine will interfere with proper switching action. Now let's look at some of these.

1. Reversed main or commutating field coils.
2. The use of improper shims under pole pieces.
3. The exchange of magnetic for non-magnetic pole-piece bolts, or vice versa.
4. Wrong location of brushes on the commutator.

All these defects will cause sparking at the brushes and overheating. You are most likely to find them after a hasty emergency repair job on the equipment.

Anything that breaks the connection between a commutator bar and its armature coil will affect commutation. This happens when the commutator gets hot enough to melt the solder and allow the ends of the coils to lift out of the riser slots. Such heating may be caused by overloads or lack of cooling air. Hence, solder throwing warns the maintainer to check the blowers and air ducts to be sure that the machine is getting enough cooling air.

A connection not properly soldered, or one that has thrown solder, may oxidize rather than lift out of the risers. When this happens, local heating will cause a blackened or burned area on the riser at the poor connection.

Molten solder can cause serious damage. An example of this is shown in Fig. 9. Here the molten solder, not only allowed the leads to lift, but also short circuited the armature coils by collecting under the insulation.

Insulation

The purpose of insulation is to prevent leakage of the electric current. If leakage occurs across a small area of insulation, it may cause sufficient heat to carbonize the surface. This lowers the resistance enough to cause a breakdown.

Looking at Fig. 2, we see that each pair of commutator bars has the voltage of one armature coil between them. If the side mica is bridged by any conducting material, the bars will be short-circuited. The current flowing across this small area will heat the mica, causing it to carbonize and glow at that spot. At high speed and voltage, this hot spot will form a ring of fire around the commutator which may cause a flashover.

Another cause of short circuits is damage to the commutator, resulting from an accident. Loose objects, such as small bolts, nuts or washers may fall unnoticed into an air duct or a commutator chamber. If such material lodges between a brush holder and the commutator, it will do extensive damage and put the machine out of service.

Not only must the bars be insulated from each other, but the whole commutator must also be insulated from the ground. This insulation has to stand the full operating voltage of the machine. It consists of relatively long creeping surfaces next to the commutator. The string band, shown in Fig. 2, is one example. When these surfaces become coated with dirt or moisture, they are no longer good insulators. As a result, there is leakage of the current to ground. When this leakage becomes great enough, the insulation breaks down and a ground results. Such failures can be prevented by keeping the string band clean.

A flashover may strike across the string band and do varying amounts of damage. If the band is only smoked up, it can be cleaned with a cloth and solvent. If the paint is burned, it can be cleaned with sandpaper and repainted. Be careful not to cut through the string. If it is seriously damaged, a new band must be applied. This is a repair job.

By watching for the warning signs described above, an alert maintainer will be able to correct troubles before costly failures result. The old proverb says, "A stitch in time saves nine", and it is certainly true of commutators. A good job of preventive maintenance will pay big dividends in increased locomotive availability and decreased repair bills.

Automotive and Electric Rolling Stock

The report of the Electrical Section, Mechanical Division, Committee on Automotive and Electric Rolling Stock was presented at a joint meeting of the Electrical Sections and the Locomotive Maintenance Officers' Association at the Annual Meeting of these organizations held in the Hotel Sherman in Chicago, September 17-19, 1951. The report was presented by Committee Chairman C. A. Wilson, assistant general supervisor, diesel engines, Atchison, Topeka & Santa Fe.

The first section of the report describes new developments in motive power with electric drive. These have been described previously in *Railway Mechanical and Electrical Engineer.*

In presenting the second section of the report on standardization of electrical features of diesel locomotives, which deals with connectors for disconnecting and connecting all four traction motor leads at once, W. S. H. Hamilton (N. Y. C.) said such a device would be of great benefit to the industry. He said tentative drawings for such a connector had been made.

Sections of the report on diesel-electric locomotives for humping service and characteristics of dynamic braking were presented by L. S. Billau, electrical engineer, Baltimore & Ohio. The latter section, which is a description of dynamic braking characteristics contains this admonition:

The braking force obtainable by dynamic braking is definitely limited by four factors. In the first place, the current which may be passed through the motor field coils in order to cause the motor to generate voltage must be kept within the current rating of these coils in order to insure against overheating. Secondly, the current output of the traction motor armature must be restricted to its current rating for the same reason. A third and very important factor is that the voltage generated must not exceed a value which can safely be impressed upon the equipment. The fourth limitation arises from the electrical design, because sparking and possible flashing occurs at the commutator if high current values are passed between the commutator and brushes when the armature rotates at high speeds.

It is concluded as follows:

Dynamic braking is a very useful by-product of electric traction and where the initial cost and maintenance are justified can well prove its worth. It is not a substitute for the conventional air brake system but may be considered a very valuable adjunct to it.

The section on humping service, which is a summation of railroad practices follows.

Diesel-Electric Locomotives For Humping Service

The requirements of a diesel-electric locomotive designed for humping service are:

1—High starting tractive effort.

2—High continuous tractive effort at very low speeds.

3—Low horsepower output.

At the present time standard switching locomotives are largely used in humping service but their characteristics are not well adapted for this purpose due to necessity for operating under reduced throttle to maintain the very low speeds required at times which operation considerably reduces the capacity of the motors due to reduced blower operation. Tests recently made of a 2000 hp., six motor locomotive operating in humping service showed an average output of less than 500 horsepower.

At present there does not seem to be sufficient demand to justify designing locomotives suitable for humping service only as their lack of flexibility and low horsepower output make them unsatisfactory for other operations.

To meet these conditions two general types of locomotives are in use to some extent. Standard heavy duty six motor locomotives are available with special control to permit low speel operation at relatively high engine speeds.

There are also in operation a few locomotives consisting of a standard switching locomotive with control arranged for operation with a separate booster or trailer unit which latter is equipped with motors only and necessary accessories in way of control, blowers, etc. Such a combination has the advantage of providing a locomotive of the desired characteristics for humping service and when not required for this operation the booster unit can be disconnected. Booster units of this type can be built at a much lower cost than a standard locomotive. Also their maintenance cost should be much lower.

Some railroads have built their own booster units converting obsolete electric locomotives in which the motors and running gear only are utilized and equipping them with the necessary blowers, control, etc.

In considering the use of equipment of this character it is essential that the traction motors have the same general capacity and characteristics of the motors on the switching locomotives which information should be developed with the manufacturers of the electrical equipment. This is very essential since in general traction motors on older equipment do not have the capacity or other characteristics of the modern traction motors used on diesel-electric locomotives.

The fourth section of the report, presented by Committee Chairman C. A. Wilson (A. T. & S. F.), gives a general description of wheel slip and wheel-slide devices and outlines the functions they should perform as follows:

A detector system should be available for all types of electric drive locomotives existing and new which will give positive indication and protection against:

(1) Wheel slip during acceleration and high speed.

(2) Wheel slide protection during air and dynamic braking.

(3) Locked wheel protection.

Due to the different types of diesel-electric locomotives in service today, this positive protection can be accomplished by the application of axle mounted equipment and this can be made standard on all types of locomotives used in all classes of service.

Most wheel slip and wheel slide protection devices now on test consist of the following:

1. Axle mounted equipment.
2. Relay Panel.
3. Alarm System.

The axle mounted equipment may consist of (1) Axle mounted commutator and brush system, (2) Individual axle generator, (3) Axle mounted centrifugal switches mounted on each power and idler axle under each unit and to operate on a mile per hour speed differential between each axle regardless of the speed at which the locomotive is being operated. On test a speed differential of 5 m.p.h. was used but this differential should be adjustable to allow for the difference in wheel size under the unit.

The relay panel consists of relays of the proper type that will operate with the axle equipment when the speed differential is reached between any axles under the unit. The relay system is connected to the main generator excitation system so that in case of wheel slip the excitation to the main generator is partially reduced unloading the diesel engine until wheel slippage stops and the engine again resumes full load slowly. The relay panel should also have a timing device with a manual reset, which will operate when wheel slippage continues for a given time, indicating an abnormal condition such as a locked wheel. The timing device must be adjustable so it can be set from 10 to 60 seconds, depending on the service of each particular railroad. This control circuit should be independent of other equipment and function even though the unit is isolated.

The alarm system of this device should operate a light and buzzer in the cab of the locomotive and in addition when the timing relay operates, it should light an alarm light on the relay panel on the unit causing the alarm, making it necessary for the relay to be manually reset and an inspection made of the unit. This alarm circuit should be a separate unfused circuit from the battery.

Such devices can be applied to the present locomotives as well as new locomotives being built and can be connected in such a manner to give any indications or operations that each particular railroad desires.

Test on various types of wheel slip and wheel slide devices are

being followed by the Mechanical Research office of the A.A.R. Central Research Laboratory. Section 5 of the report concerns a request made by a manufacturer to add six incandescent lamps for diesel locomotives to the standard list which now includes only 19 lamps.

Battery-box temperatures and relays to indicate blown battery fuses constitute the sixth section of the report as follows:

The New York Central Railroad has applied a "Klixon" thermostat to three 1000 hp. diesel-electric switching locomotives for tests. The thermostat is mounted above the batteries on a wooden base fastened to the inside of one of the battery boxes and is designed to operate on the air temperature inside the battery box. The thermostat is connected to the voltage regulator and will regulate the battery charging voltage to 75 volts when the air temperature inside the battery box is above 50 deg. F. When the temperature is below 40 deg. F., the battery charging voltage is raised to 77 volts.

This installation was made in May and June 1951 and no conclusive information has been obtained regarding the results or merits of this application.

The Southern Railway System has equipped their passenger booster units with a no charge relay and light for indication of blown battery charging fuse which energizes the alarm circuit on the locomotive and lights a red alarm light mounted on the low voltage cabinet in the unit affected.

The no charge relay is connected across the battery charging fuse in parallel with the fuse and has one normally closed interlock. The interlock is in the circuit to the operating coil of the battery charging contactor and one normally closed interlock is added to the battery charging contactor. The no charge light is connected, through the closed interlock on the battery charging contactor, between the signal negative and to the circuit from the isolation switch to the E. R. Relay.

When the battery charging fuse is blown, the no charge relay will pick up, the interlock on the relay drops out the battery charging contactor, and the interlock on the battery charging contactor is closed, lighting the no charge light and energizing the signal relay and the alarm is received. The alarm and light will stay on until the fuse is replaced or the isolation switch is put in the start position.

Standardization on location and arrangement of receptacles and jumpers on diesel-electric locomotives is the subject of the seventh section of the report. A table and a diagram are included to show a proposed arrangement of jumpers and receptacles.

The eighth and final section is a tabulation of replies received in answer to a questionnaire sent to chief mechanical officers, asking their preference as to the function and location of visual and audible alarms.

Discussion

R. I. Fort (I.C.) asked for a brief description of the 6 new lamps proposed for use on diesel locomotives by one manufacturer. W. S. H. Hamilton (N. Y. C.) replied that some were 75-volt lamps of different capacities and that one is a 220-volt lamp. It has, he said, been the desire of the committee not to exclude lamps which are required, and also not necessarily to increase the number of different lamps. The original number, he said, was 64 which has been reduced to 19.

Concerning the use of a no-charge relay and light for indicating blown battery charging fuses, Mr. Fort asked why it is necessary to add another device to a locomotive, since little trouble has been experienced from this source. "We do," he said, "have a pilot light across the battery charging contact to show if the battery is charging or not."

It was then pointed out that when the battery fuse blows on some types of locomotives, the ammeter will show about 17 amp., indicating that the battery is being charged and that for this reason the relay and light is good. Mr. Fort said that a few years ago, trouble had been experienced by the blowing of battery fuses caused by starting one engine with the other engine running, but that this was now prevented by an automatic disconnecting of charging circuits when the starting button was depressed.

In response to a question from H. C. Paige (N. Y., N. H. & H.) concerning the requirements of controlling battery charging voltage to conform with battery temperature, Mr. Hamilton said that in addition to the thermostat, there is need for only a few feet of wire and a resistor.

Following the discussion of the automotive and electric rolling stock report, a paper entitled, "Diesel Wheel Slippage Investigation by the New York Central," was presented by F. Thomas, assistant to general superintendent equipment, diesel and electrical, New York Central. This paper was published in the October 1951 issue of *Railway Mechanical and Electrical Engineer.*

CONSULTING DEPARTMENT

Cleaning and Testing Of Locomotive Electrical Equipment *

Questions and Answers

Q.—How can carbon be cleaned from traction motors and main generators without dismantling the equipment?

A.—The primary considerations are the design and location of field enclosures, whether or not moisture and other adhesive agents are present in addition to the dust within the field casings, and the skill of maintenance staffs with type of tooling which is provided.

The unanimous opinion is that a dry air blow is the best, where no adhesive agents are present. Metal or hard rubber tube extensions for the air hose allow the air blast to be applied at the critical points. While blowing, an exhaust arrangement should be used to carry away the dust boken loose. This can be obtained simply on most equipment by operating locomotive auxiliary fans.

The too frequent case is that a bonding agent is present to make the dirt stick. There are two schools of thought as to the proper method of dealing with this condition.

One view is that air is still the only satisfactory method. The concern of those holding this view is that direct spraying of a solvent into the machine may force a build-up of deposits in inaccessible locations, making matters worse than when the cleaning was started. If a solvent spray is not used, the technique generally employed is to first blow with dry air, wipe creepage surfaces with a clean rag dampened with solvent, use a fine grade of sandpaper to clean the hard carbon, and reblow.

The other view as to cleaning out carbon and oil is that a solvent must be sprayed into the machine to effectively

* Material presented by the Diesel Electrical Committee at the annual meeting of the Locomotive Maintenance Officers Association held in Chicago, September 17-19, 1951

remove the accumulation and that this practice is all right as long as the material is allowed to dry before any high potential test is applied. On most railroads the use of carbon tetrachloride in pure form is not permitted and where it is used, a mask is provided which affords complete protection to the user. The substitutes which are used are such materials as Stoddard's solvent Nareco solvent, Dearborn 91, or a mixture of 93 per cent mineral spirits and 7 per cent carbon tetrachloride.

For the solvent spray process, a through technique is as follows: Blow the equipment thoroughly, then spray and let the solvent set for 15 to 20 minutes. Scrub with a brush, using brushes to reach the difficult places. After this is done, spray and blow again thoroughly.

Another cleaning method, which is in limited use only. is the blasting with cornmeal. The problem here is how to keep the cornmeal from imbedding in the wrong places, soaking up moisture, and eventually causing grounds.

Q.—What is the easiest method of drying out electrical equipment after it has become wet?

A.—The common method employed for drying out main generators is to blow the generator with dry, warm air in a warm building and then, if possible, place the generator under a small load. If the foregoing fails, the practice is to remove the generator and bake it in an oven.

To dry out traction motors, blow and feed warm air into the traction motor blowers with the blowers running. Throughout the drying process, the resistance of the traction motor to the ground is checked. Also, it is sometimes possible to operate the locomotive at slow speed, combined with a light brake application.

Various devices are available for blowing hot air into the electrical equipment. With each device, a flexible duct or tube can be used to conduct the heat directly to the desired location. One device is a portable heater which burns fuel oil, the exhaust gases being mixed with fresh air and drawn by a fan into the heat conducting tube. The temperature is in the neighborhood of 200 deg. One railroad has conducted experiments which, they say, prove that best results can be obtained by the use of multiple portable, forced convection, electrically-operated space heaters utilizing air discharge temperature in the order of 170 deg., and so designed as to create good control of the hot air blast, together with maximum turbulence within the electrical machine.

Also for the wiring, heat lamps have been used with some success. Drying wire which is inside a conduit is difficult. An expedient which is used in one case is to build a fire inside a nest of steam generator coils, running air through these coils and directly into the conduit.

Q.—How can dirt and moisture be kept out of electrical equipment?

A.—This subject ties in with the general winterization scheme used on a locomotive. The ventilating air intake for the main generator, traction motors, or electrical cabinets must not be directly exposed in any way to outside air because this air will have snow, water or dirt entrained with it under severe operating conditions. The general principle is that all of these air requirements should be supplied from within the engine room. The sides and under surface of the locomotive should be closed up tightly and all of the engine room air requirements supplied up high near the center of the locomotive. In this manner, moisture and dirt which may be entrained with the intake air can be dissipated before it reaches the actual point of air supply to the electrical equipment.

Two winterization schemes are used successfully on northern railroads. One is to obtain all air requirements through a separate hatch opening in the roof after blocking all of the engine room side panel air filters. The other method is to only partially block the engine room side panel filter openings, partially open the engine room false ceilings, and reverse the rotation of one of the engine-cooling fans. In both cases all openings underneath the main generator and high voltage cabinets are blocked off and the underside of the car body sprayed with Insulmat to insure a positive seal.

Two other interesting developments or proposals which are being investigated are the use of dynamic grilles to buff off the dirt and snow at air intakes and the possible use of a heater winding within the electrical machine.

Q.—How long does wiring last and how can its service life best be increased?

A.—Cases are known where railcars built in 1925 and 1926 are still operating with the original wiring. However, present day locomotives with varnished cambric wiring will not last more than six to ten years. The traction motor leads may last only three years. It is expected that the Neoprene or Anhydroprene wiring now being tried will last longer because of its resistance to oil and moisture, but the real answer is to keep the wires out of the oil and moisture and perform periodic cleaning and painting. Keeping oil and moisture away from the wires is nearly impossible with some designs. It is the unanimous opinion that a great deal could be accomplished by side or top connecting main generators.

Q.—What practical measure can be taken to eliminate junction boxes, conduit bushings, and water pockets under the floor?

A.—Where necessary to run conduit under the floor, it should be the longest practical length, eliminating as many fittings as possible. The terminations of the conduit should be periodically inspected and carefully sealed to prevent water or oil getting into the conduit from the ends. Wiring pits should have a medium size drain hole with a pipe extension leading down and terminating at a point about six in. above the rail. Thus, if water should collect in the pit, it will drain off and the danger of snow or dirt entering from the underneath is minimized by the length of the pipe. Such drains must, of course, be periodically inspected to be sure that they are open. On one type of passenger locomotive, an improvement can be effected by eliminating the steam trainline expansion joint which is under the floor and near the main generator pit. When this joint leaks, vapor comes up through the engine room deck and gets into the wiring or the main generator. With the joint eliminated, the expansion is taken care of by using two swivel type joints in the steam trainline at the rear end of the locomotive, as it leaves the steam separator at the steam generator to enter the main steam trainline.

Q.—Should a traction motor receive a light cleanup and the bearing run at the time of wheel change, regardless of whether or not the motor has reached its overhaul mileage?

A.—It is generally agreed that this is a good practice to follow, particularly because it gives a good opportunity to check on the bearing condition. The secondary reason for so doing, is that the brush rigging and creepage surfaces are more accessible and can be better cleaned than when the traction motor is underneath the locomotive. On one railroad it is also believed desirable to check the commutator at this time with a dial indicator for a maximum of .002 run-out.

Q.—What is the most satisfactory method of applying voltage and current tests to a traction motor, both prior to and after overhaul?

A.—The primary instruments are the megohm meter and the high potential tester. An excellent type of high potential machine uses a transformer with primary control, two rectifier tubes, a 2,000-volt, 1-mf. condenser and a d.c. voltmeter connected across the test leads. With this type of machine, it is possible to tell the exact voltage at which the insulation is breaking down without damage to the equipment under test. Up to 1,200 volts can be applied prior to the overhaul. If loose joints or high resistance connections are suspected, a low reading ohm meter can be used during the preliminary testing. After overhauling, a high potential test of 2,000 volts should be applied and, in addition, a high frequency test made where the equipment is available. Then a one-hour bearing run should be made, using a motor generator set type of testing machine which will apply 450 amp. to the field circuit and 1,000 volts to the armature circuit. With the traction motor running, the motor may be checked again for grounds by connecting a voltmeter from the various motor leads to ground.

Diesel-Electric Locomotive Batteries

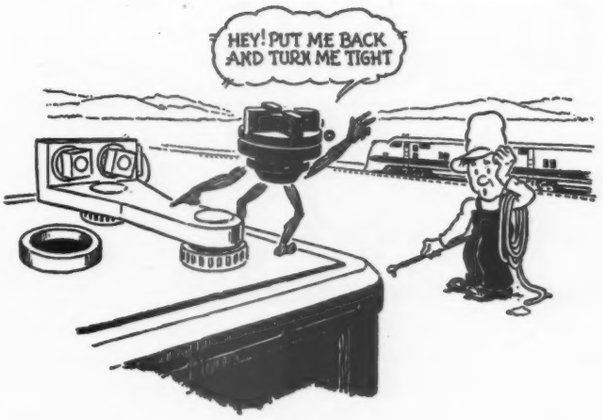
Questions and Answers

Q.—What care should be given to battery vent plugs?

A.—Keep the vent plugs securely in place at all times, except when taking hydrometer readings or adding water.

All vent plugs are provided with small openings for the escape of gas. Clogged openings may cause sufficient gas pressure within the cell, to break the seal between the jar and the cover. If these openings are found to be clogged with dirt, when examined during any inspection, they should be immersed in water and thoroughly cleaned. It may be necessary to use a piece of wire to clear the openings.

White porcelain vent plug in right foreground indicates the next cell to be used in taking a hydrometer reading. Mechanic is checking cell voltage with voltmeter



If a battery vent plug could talk, this is what it might say

The Electric Storage Battery Company recommends that accumulated gum or grease deposits on the plugs be removed by cleaning with carbon tetrachloride or Stoddards Cleaning Fluid. Remove cleaning fluid with low pressure air

A cracked vent plug, or one upon which the soft rubber gasket does not seal tightly, or from which the hard rubber disc below the gas chamber has been lost, must not be used.

Vent plugs, when removed, should be placed bottom side up, on the battery covers. When a vent plug is laid right side up, the dirt it picks up may be introduced into the cell, contaminating the electrolyte, which, in turn, may shorten battery life.

Cell covers damp with electrolyte may indicate clogged vent openings. Damp covers also may be caused by poorly applied plugs, addition of too much water or a break in the seal.

Q.—Why rotate battery vent plugs?

A.—Each time a hydrometer reading is taken, a small amount of electrolyte may be lost. If one cell is read continuously, its fully charged specific gravity will gradually be lowered, resulting in individual low cells.

To avoid excessive loss from any one cell, The Electric Storage Battery Company recommends that a different cell be used in each half of the battery every time a gravity reading is taken.

By the use of a special plug (white porcelain or painted), the change in cells can easily be marked and followed as is indicated in the photograph. Start with the positive terminal cell in each half of the battery, and follow the series circuits until the negative terminal cell is reached. The special plugs should then be returned to the positive terminal cells, and the same routine repeated.

Therefore, after each hydrometer reading change the white porcelain vent plug to the next cell, thus moving progressively through the battery circuit so that all cells will be read and recorded about every four months.

S. K. LESSEY
The Electric Storage Battery Company

EDITORIALS

Santa Fe Diesels Quickly Reconditioned

Numerous railroads and private car companies experienced severe damage to equipment during the record-breaking Kansas floods last July and are to be commended for their success in restoring service as quickly as they did. One of the most spectacular performances was that of the Atchison, Topeka & Santa Fe which had about 5,500 freight cars, 21 steam locomotives and 51 diesel units involved in the flood and, by organized, intensive effort on a three-shift basis, put most of this equipment back in service in a month. As a matter of fact, the 51 diesel units were reconditioned at Santa Fe system shops in 17 working days.

With water up to 22 ft. deep in the Argentine enginehouse, 26 ft. on the car repair tracks and some of the equipment fully submerged for six days, the magnitude of the job can hardly be overestimated. About 650 cars had to be rerailed and in many instances car bodies reassembled on trucks from which they had floated away. By working full crews of men around the clock, car forces repacked journal boxes on 350 cars a day. AB brake valves were replaced with serviceable equipment or removed and cleaned thoroughly on all cars regardless of ownership, foreign lines not being billed for this cleaning operation.

Experience in reconditioning 16 road diesel units and two general-purpose diesels at the San Bernardino, Cal., shops was typical. Before moving the locomotive units, suspension and axle-journal bearings had to be cleaned out and repacked, armature bearings lubricated, gear-cases cleared of mud and silt and new crater compound applied. On arrival at San Bernardino, mud and silt still filled the cabs and engine rooms to a depth of six to eight inches and all of the electrical cabinets were caked with mud, conduits and junction boxes below the floors being completely packed with fine silt which hardened like flint when dry.

The damage by corrosion to electrical equipment was severe, especially wiring, contactors, voltage regulators, flexible shunts, terminals, and load regulators. In some instances, all of the equipment in the high- and low-voltage panels was damaged to such an extent that it was beyond repairs. One unusual fact noted was that the corrosion of electrical parts continued after being cleaned with high-pressure hot water, and that this action was retarded by spraying all parts with kerosene.

Other observations of interest were that varnished cambric insulated wire, with cotton binding, did not stand the exposure and immersion in water, but coils and wires coated with Sterling or Glyptol paint experienced little damage. Okonite Okoprene wire was reported as showing great resistance both to oil and water damage.

All types of heating facilities were used with varying degrees of success to dry out equipment after washing, and these facilities included a large dry kiln, heat-treating furnace, steam heaters, infra-red lamps and internal electric heating of armatures. A Scheu Hot Shot heater worked well in drying out diesel engine and electrical parts, including water-soaked conduit, with a flow of hot, dry air under low pressure. As a matter of fact, individual machines of this type delivered up to 1,600 cu. ft. of air per min. at 250 to 300 deg. F., equivalent to the release of 300,000 B.t.u. per hr. with a fuel rate of 2¼ gal. of fuel oil or kerosene per hr.

Diesel locomotive builders cooperated by supplying materials to the fullest extent possible in the rehabilitation program and the balance of parts reconditioning and assembly work at San Bernardino shops was handled on a production basis by specialized groups well supplied with all necessary tools and equipment. Flood-damaged diesels, as well as 10 wrecked units were repaired at San Bernardino in addition to current operating requirements and, during August, a total of 85 diesel locomotive units was released at this shop. The electric shop output included 195 traction motors (40 armatures rewound) and 21 main generators (7 armatures rewound). Also during the month, 20 diesel engines were completely dismanteled and rebuilt.

While no considerable percentage of diesel motive power on American railroads will ever be subjected to flood conditions such as occurred in Kansas last July, experience on the Santa Fe and other roads indicates the desirability of making diesel locomotive parts, especially electrical equipment, as highly resistant as practicable to oil and water damage. Alert manufacturers are already working on this end.

An Example of How Good Maintenance Pays Off

One of the papers presented before the last meeting of the Air Brake Association, and which is abstracted elsewhere in this issue, outlined three positive benefits that accrue from intensive maintenance. While the good maintenance and the benefits referred to apply specifically to certain phases of air-brake work, there is little reason to believe that equivalent gains would not result from equivalent standards of maintenance on other railroad equipment.

Three positive benefits from the high standard of maintenance are given. One, the brake operation is decidedly improved, reducing overbraking and overuse of the brake, and giving such contingent benefits as considerable savings in fuel and air. Second, on high-speed

streamliner service traversing both level and mountainous terrain, brake shoes are constantly averaging 25,000 to 30,000 miles of life. Third, there is a substantial reduction in brake-rigging wear—so little that after some 650,000 miles of service, no serious wear occurred, and the indications are that parts will not require renewal until nearly a million miles of usage.

The committee that prepared this report stated at one point: "It appears to us, therefore, that there can be no doubt, it is far less expensive in the long run to do a complete, careful and thorough job of preventive maintenance and have the benefit of improved service, long life and reduced repair costs, than it is to do a minimum job and have the disadvantage of poorer service, shorter life and higher repair costs."

Who doubts that this conclusion is equally applicable to car and locomotive maintenance other than parts of the air brake system?

Catch Them Before They Get Sick

Railway passenger traffic is being increasingly encroached upon by airways and highway competition. This is not made evident by looking at passenger traffic alone, but it becomes significant when the traffic volume figures of the different kinds of transportation are compared.

The situation raises the question: What is passenger traffic worth to the railroads and what should be done about retaining what they have or increasing their percentage? The defeatist says: "It will only be a matter of time before all passenger traffic goes to the airways and the highways—it doesn't provide us with any net income anyway."

But nearly everyone agrees on two things. These are that passenger service has an important bearing on public relations with the railroads, and that reduced cost of transportation has a salutary effect on volume. For nearly all of the long-haul service, the railroads have gone in for de luxe service and few have made any sincere attempt to increase volume by reducing costs.

So the passenger pays a good price for fine service. He expects to get what he pays for and objects to anything short of the best. An air conditioning failure in hot weather may cause him considerable discomfort, and when the railroad deliberately puts him into a car which has been out in the yard in the sun for hours and in which the air conditioning has failed he is the victim of fraud. The railroad charged him for something he didn't get.

That is why, at the recent meeting of the Electrical Sections, it was said that a car with failed equipment should be held out of service—that an air conditioning failure was just as important as a locomotive failure. To the passenger, it may be more important. In one case, he loses a little time, and in the other, he suffers discomfort.

At the same meeting referred to, it was the consensus of opinion that most failures are caused by inadequate maintenance, and that this, in turn results from too few adequately trained maintainers. It becomes necessary to let equipment go extra trips with the hope that it will come back in operative condition.

Correction of the situation requires more attention to preventive maintenance, but this does not necessarily mean higher maintenance costs. It is much cheaper to keep well than to be doctored after you are sick. It is also a lot more pleasant both for you and your family.

NEW BOOKS

SIMPLIFIED MECHANICS AND STRENGTH OF MATERIALS *By Harry Parker, professor of architectural construction, University of Pennsylvania. Published by John Wiley & Sons, 440 Fourth avenue, New York 16. 275 pages. Price, $4.*

Following the pattern of other books in the "Simplified" series, the sixth volume contains an elementary treatment of the subject for use by practical men interested in mechanics and construction. The author, using simple arithmetic and algebra, concentrates on material bodies in which there is no motion. After a general survey of all the mechanical forces to be considered, he discusses their specific applications to columns, rivets and welds, shafts pipes and tanks, concrete and retaining walls and dams. A wide variety of illustrative problems is included, also tables of allowable stresses, properties of sections, and other useful engineering data.

INSPECTION AND GAGING. *By Clifford W. Kennedy. 512 pages, 6 by 9 inches; 319 illustrations. Published by The Industrial Press, 140-148 Lafayette St., New York 13. Price $7.50, plus 62 cents for shipping to Canada or overseas.*

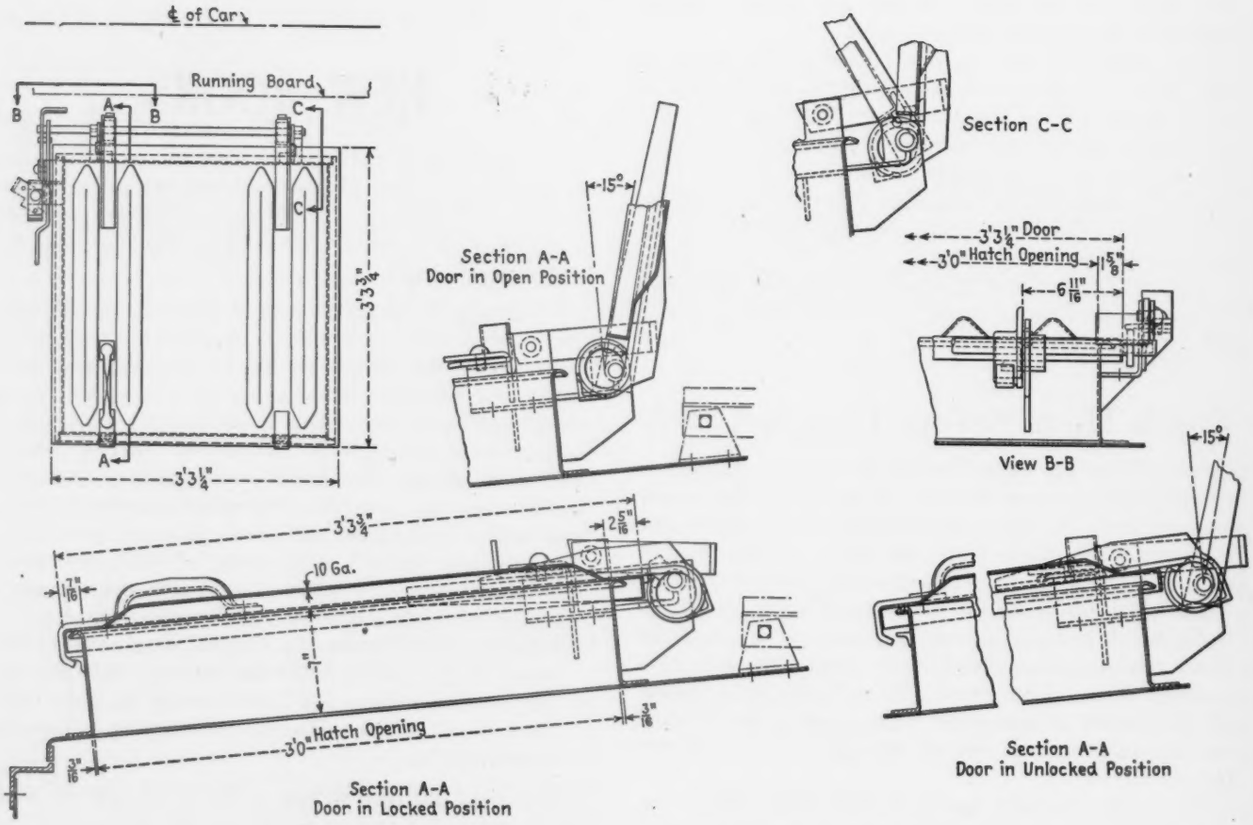
This book has been written primarily to meet the need for a text and reference work that can be used in the training of inspection personnel.

The author deals with the many phases of inspection work and their application to present-day manufacturing operations. He describes in detail a wide variety of manual and automatic measuring tools, devices and gages, and shows how they can be used accurately and efficiently. Not only are the best procedures for securing accurate results given, but possible errors to be avoided are clearly described. Inspection problems are analyzed, and the steps in solving them illustrated.

The seventeen chapters in the book deal with the following subjects: The Need and Function of Inspection; How Specifications Aid the Inspector; Tolerances and Allowances; How Standards Aid the Inspector; Basic Principles and Techniques of Measurement; Fixed Gages; Surface-Plate Methods and Equipment; Mechanical Indicating Equipment; Electrical and Air Indicating Equipment; Optical Measuring and Inspection Equipment; Gaging and Inspection of Screw Threads; Special Measuring and Inspection Problems; Gage Checking and Calibration; 100 Per Cent Inspections; Quality Control and Sampling; Process Inspections; and Hints on Making a Good Job Better.

Half-tones and line drawings form a useful reference for those who wish to become acquainted with the wide variety of gaging equipment and measuring tools and devices now available.

NEW DEVICES



Latitudinally operated hatch cover and frame for covered hopper cars

Automatic Locking Hatch Cover

The outstanding characteristic of the eccentric actuated and automatic locking hatch cover for covered hopper cars is its safety of operation. Developed by the Youngstown Steel Door Co., Cleveland, its unique design positions the shaft and operating lever of each mechanism near the running board of the car roof.

Operation of the levers and the opening and closing of hatch covers compels the men to stand in proximity to the middle of the roof. In the event of accident, these men will be protected.

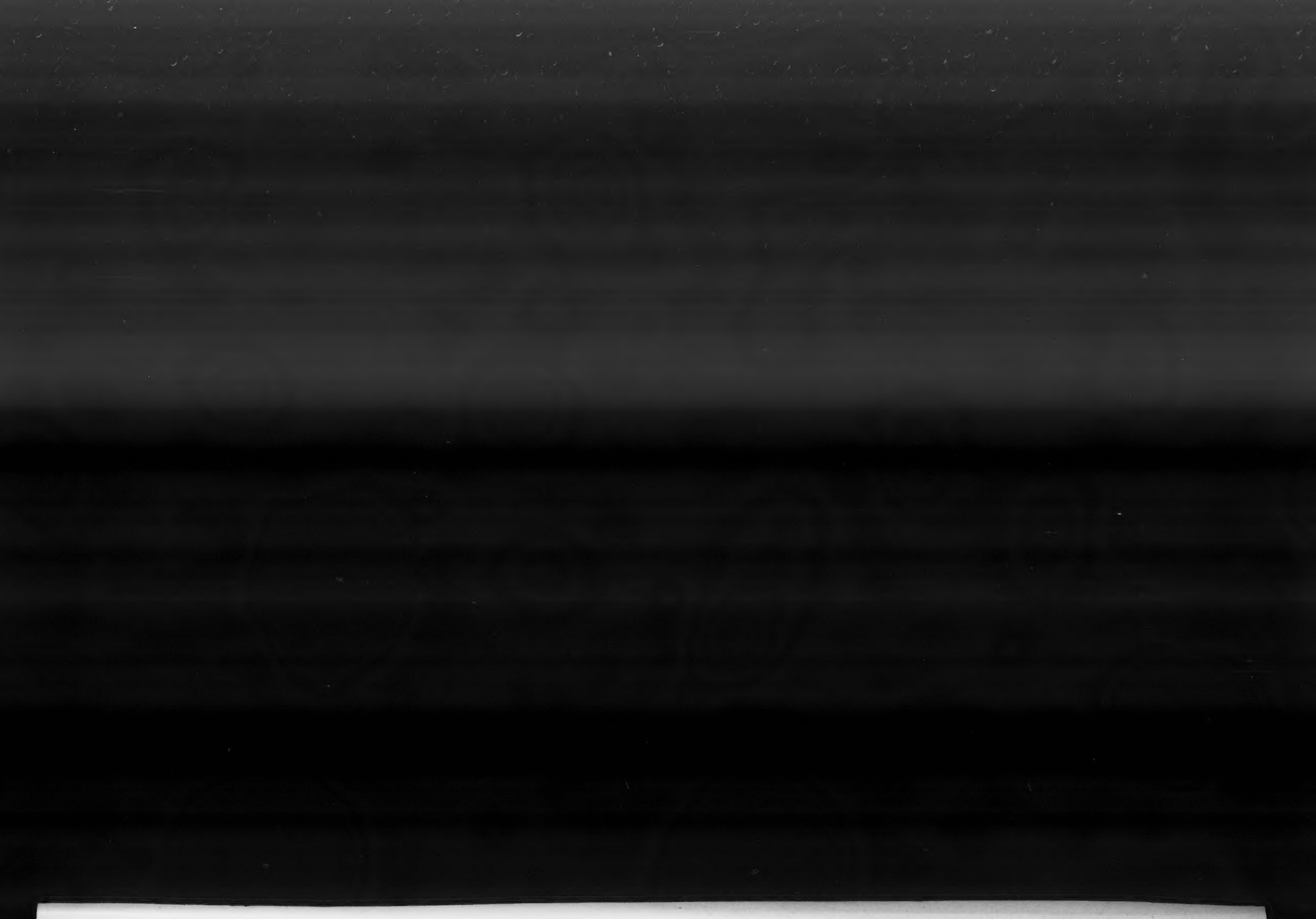
The hatch frames to which the covers are hinged are of conventional construction and carrry the entire operating mechanism. On single units, embodying one cover, one frame, and one locking mechanism each, the unit is ready for service as soon as the frame is secured on the roof. The cover is formed with a pair of corrugations extending parallel and adjacent to each side thereof. Hinges formed of rolled angle members are secured to the portion of the covers adjacent to the running boards. The hinge pins are cams eccentrically mounted on a shaft which rotates in butts carried by the hatch frame. The shaft is actuated by a lever. When the cover is closed, the lever is locked by a latch, also carried by the hatch frame, and can be sealed. Locking members on the side of the cover opposite the hinges extend between the corrugations so that these serve to stiffen the covers and provide a tie between the hinges and the hook-shaped locking members. These lock by engaging angles on the hatch frame as the cover is seated. This is brought about by closing the cover, the hook-shaped members clearing the angles on the hatch frame because of the position of the eccentric hinge pin. Swinging the lever toward the roof after the covers have been lowered produces rotation of the shaft and eccentric hinge pin. This causes the cover to move on the frames toward the running board which engages the locking member over the angle and also lowers the hinge end of the cover upon the frame. The sealing contact between the cover and the hatch frame makes the device a favorite of shippers of molding sand and cement.

To open the covers the lever is moved upward toward the running board and is automatically locked by a swinging latch. This moves the cover away from the running board and releases the lock so that cover can be lifted to open position.

It is impossible to damage the covers or locking mechanism by improper operation. The lever cannot be swung through such an angle that it can be made to lie upon, or foul, the running board. Lowering the lever to the roof before the cover has been closed is also prevented by an interlocking engagement with the cover which also prevents the latter from being closed until the lever is returned to its fully open position.

The drawing illustrating the device shows a single latitudinally operated cover. The hatches can be arranged so that they open longitudinally parallel to the running board. In this case the operating lever is alongside the running board. Two latitudinally operated covers can also be arranged for dual operation. This involves connecting the two 1-in. shafts with a 1-in. pipe coupling and operating both with the lever device on one of the covers.

(*Turn to page 104*)



HOW UNIT EXCHANGE SAVES YOU TIME AND MONEY

WHEN you order a Unit Exchange assembly from Electro-Motive, you receive from our pool a completely rebuilt, fully guaranteed unit—shipped F.O.B. our nearest Factory Branch.

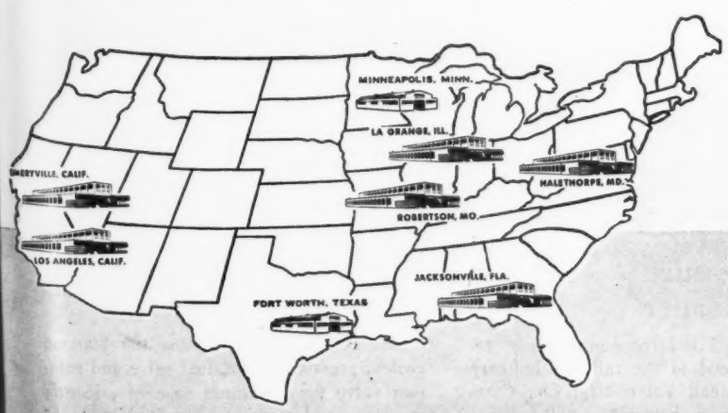
There is no waiting for your own unit to be rebuilt—no need for large inventories. We carry the spares for you—and there's no extra charge for this service.

You pay only the cost of bringing the unit you send in up to standard—and the price is determined solely by the material and labor needed to rebuild your unit.

Because of volume operation and modern laborsaving techniques, Electro-Motive rebuilding costs pace the industry. We ask you to check that statement—put our published flat-rate prices for highest-quality work against any others, and you'll see what cold-turkey truth it is.

And don't forget *every* assembly rebuilt by Electro-Motive (whether Unit Exchange or Rebuild-and-Return) carries the same guarantee as new—*100,000 miles or one year of service*, dating from time of application on the locomotive, *not* the date of shipment.

Let us show you how much Unit Exchange can save your railroad. Consult your Electro-Motive representative, or contact nearest Factory Branch or Parts Warehouse listed below.



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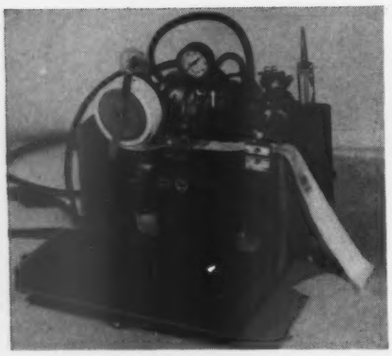

Continuous Gas Filtering Recorder

This is a multi-purpose instrument for laboratory maintenance processing that is applicable as a recorder of transient phenomena; monitor for equilibrium condition; pick-up for warning systems; operator of control devices and a detector and locator of leaks.

The medium under test is sampled at a uniform rate through a continuously progressing filter tape, guided past a recording head. Adjustment of sampling rate and selection of both tape speed and working area in the head give a wide range of sensitivity and facilitate calibration.

The unit can be utilized for recording gases in three basic groups: (A) combustion—exhaust and smoke of gasoline, diesel, turbine engines, oil burners and furnaces; (B) air pollution—dusts and aerosols in industrial plants, mills and blast furnace gas and (C) mixed gases such as carbon, sulfur, compounds or fumes.

In group A, tests are evaluated by a visible deposit of carbon particles. In group B, colorless dusts are made visible by chemical action and in group C, except in the case of certain fumes, tests are made with the tape activated by suitable reagents to produce a visible record.

The device, made by E. K. Von Brand, Dobbs Ferry, N. Y., utilizes a 110 volt, 60 cycle power supply and is equipped with independent switches for vacuum pump and tape movement that permit spot testing with internal timers.

◆

Lens Tissue and Dispenser

Designed for use in keeping safety goggles clear, a new large size silicone treated lens tissue and metal dispenser has been made available by the American Optical Co., Safety Products Division, Southbridge, Mass.

These tissues, treated with a coating of silicone, quickly remove from lenses foreign matter such as dust, dirt and finger marks. Tissues, by depositing the silicone on the lenses, make each wiping last longer and the next cleaning easier and faster.

The dispenser is of 20 gage steel construction and is furnished with four mounting screws and a lock to prevent pilfering. This unit allows the removal of only one 5 by 6¾ in. sheet at a time.

◆

Terminal Block for Traction Motor Leads

A device for reducing the time required for change-out of traction motors on diesel units is now being offered by the Paxton-Mitchell Company, Omaha, Neb. It consists of a terminal block fitted with Williams grip connectors, and the manufacturer claims that taping and untaping cables and the maintenance of glad hands at every change-out is no longer necessary. Only a ¼ turn of the buttress thread nuts is required to tighten cable connections.

The terminal block is made of neoprene to assure proper insulation of terminal connections in all kinds of weather. The terminal connections are made of a special alloy copper to assure the highest conductivity of electrical current. The connectors are so designed to assure equal contact pressure over the entire mating surface of each connector and also provides for a tensile pull of 1,500 lb. Connectors which become damaged may be renewed without replacing the complete block. Tests and service applications have shown that the connectors will perform satisfactorily in snow and ice and under other adverse weather conditions.

High Pressure Steam Cleaner

The model JO Hypressure Jenny recently introduced to the railroad industry by the Homestead Valve Mfg. Co., Coraopolis, Pa., is a heavy-duty, all-purpose steam cleaner. It operates at 80 to 120 lb. pressure, and has a 90 gal. per hr. capacity.

Featuring the convenient no-stoop control panel and its high capacity of boiling hot cleaning spray, the unit combines simplicity of design and construction with convenience of operation.

The control panel groups the starting switch, pressure gauge, fuel valve and solution valve for maximum ease of selecting pressures and solution concentration to fit the job on hand. This device operates on the continuous flow principle, not nozzle controlled. It starts automatically when drop cord is plugged into an ordinary electric outlet and stops when plug is removed.

ONLY TIREX
HAS THE SELENIUM NEOPRENE ARMOR

Only Simplex-TIREX cords and cables are jacketed with the famous Selenium Neoprene Armor. This famous cured-in-lead jacket is well known wherever tough, hard jobs are found. Whether it is coal mining, ship building, open pit mining operations, rock quarrying or foundry work the tough, cured-in-lead jacket provides the kind of staying power that you want. Wherever rough, abrasive conditions are found, there you will find the jobs that TIREX excels at doing.

Actual service records show that Simplex-TIREX cords and cables have proved to be the most economical because the Selenium Neoprene Armor lasts so long.

Whenever your requirements call for the use of a portable cord or cable, specify and be sure that you get Simplex-TIREX Cords and Cables.

If it isn't made by Simplex it isn't Tirex

Simplex - WIRES & CABLES

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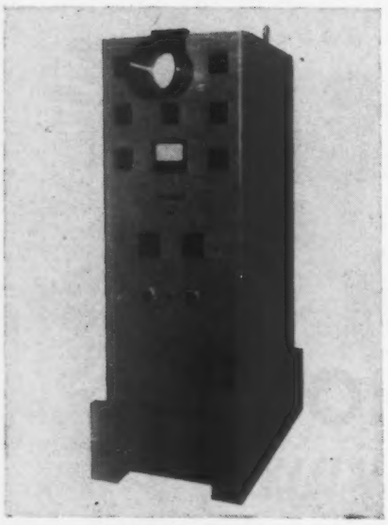

D. C. Armature Insulation Tester

A winding-insulation tester for d.c. armatures, series field coils, and low-impedance a.c. stator coils, has been announced by the Special Products Division of the General Electric Company. The device will detect and aid in locating faults in turn-to-turn, coil-to-coil, and winding-to-ground insulation in d.c. armatures of any size and rating. It is designed for testing large motors and generators such as those in railroad service.

The tester consists of a repeating type, surge-voltage generator which operates 60 times a second and a cathode-ray oscilloscope, all in one cabinet. A fixture is provided for applying test voltage to the commutator of the armature being tested.

According to G.E. engineers, the new tester can check an entire armature in as little as three or four minutes. As each coil is being inspected, the operator has merely to glance at the oscilloscope screen to see if the surge wave shown is of proper shape and amplitude. Any variance from the correct wave indicates a fault in the tested armature.

The heart of the new device, the surge generator, consists of a 0.5 mf. capacitor which is charged in one-half cycle and discharged in the next half cycle. Voltage on this capacitor is adjustable in two per cent steps up to a 7,500-volt peak by means of two tap switches and an autotransformer. The discharge takes place through a pair of ignitron rectifiers connected back to back. This system permits oscillatory output and complete discharge of the surge capacitor. Coaxial cables conduct the surge to the commutator contact fixture.

Once triggered by the surge, a standing wave is shown on the oscilloscope screen. Sensitivity is variable by voltage divider so that the surge-wave picture may be adjusted to convenient proportions for the full range of surge voltages. Insulation faults are indicated by a change in wave shapes or amplitude or both.

The tester is 20 in. wide, 30 in. deep, 48 in. high, and weighs approximately 800 lb. It operates on a power supply of 230 volts, 60 cycles, and is three-wire, single-phase fused for 30 amp.

◆

Ultrasonic Testing Service

Testing with the Reflectoscope and Reflectogage is now being offered by Sperry Products, Inc., Danbury, Conn., to industrial concerns which have occasional need for ultrasonic non-destructive testing, but whose needs do not warrant purchasing an instrument or training an operator.

This field service provides day-to-day testing at the customer's plant or designated location by an engineer with Sperry's apparatus. The customer is furnished with a report of condition of material at the conclusion of the test.

The Reflectoscope locates discontinuities in metals and plastics by directing pulsed ultrasonic beams through the material and measuring elapsed time of reflections from the discontinuities in the path of the beam. This unit can be used for checking stock before machining, for quality control, maintenance inspection of parts subject to fatigue cracks, etc.

The Reflectogage measures thickness of metals and other materials up to 4-in., from one side only.

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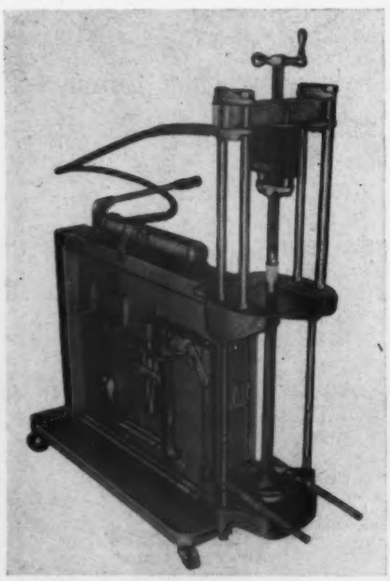


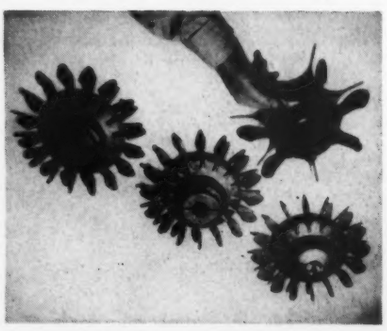
Hydraulic Tool Puller

Recently announced is the Portable Hydra-Tote, a unit that takes pulling tools to the job in place of hauling the job to the tools. Made by the Owatonna Tool Co., Owatonna, Wis., it holds the complete OTC hydraulic pulling system. With the OTC hydraulic Power-Twin Ram and Pump combination, the device is ideal for maintenance work and is easily moved to any spot in the shop. In addition, it provides a 17½ ton hydraulic press.

This unit provides a place for a complete OTC puller set. Permanent steel hangers for basic items and a tray for extra parts to reduce the danger of losing or misplacing tools.

Of sturdy, welded steel construction, it is 32 in. high, 36½ in. long, 16 in. wide at the base and 4 in. wide at the top. There is 10½ in. clearance between the press uprights, 11 in. clearance from the ram to the top of the press plate and 34 in. from top of press plate to the floor. Vertical adjustment is possible with interchangeable legs in the upper press frame and three easy adjustments in the lower press frame. It is equipped with 3 in. rubber casters for easy mobility.

◆



Plastic Motor Ventilating Fans

Plastics are now being used by the Westinghouse Electric Corporation to replace critical aluminum and bronze for blowers in small, totally-enclosed, fan-cooled a.c. motors. The plastic blowers consist of a polyester resin, reinforced with glass fibers. Glass fiber reinforcement has been found to be superior to organic fiber reinforcement because of increased resistance to chemical attack, and increased strength per pound.

The plastic blower has many advantages over the aluminum and bronze blowers it replaces. It is unaffected by the chemical agents that attack the metals. Hence, it is desirable on motors used in refineries, chemical plants, and process industries where corrosive atmospheres may be present.

The plastic blower is as much as one-third lighter in weight than its metal counterparts. While this may be but a matter of a few ounces, the reduction of inertia where frequent, rapid reversals are required is worthwhile. Preliminary tests indicate that the plastic blower has better resistance to abrasion than its predecessors.

These advantages are obtained without sacrifice in blower performance. The blower has successfully passed overspeed tests at four times normal speed. Westinghouse currently is applying these new plastic blowers to totally-enclosed, fan-

(*Continued on page 136*)

RUGGED DEPENDABILITY FOR TOUGHEST DUTY ON ANY 'ROAD

QUAKER HOSE

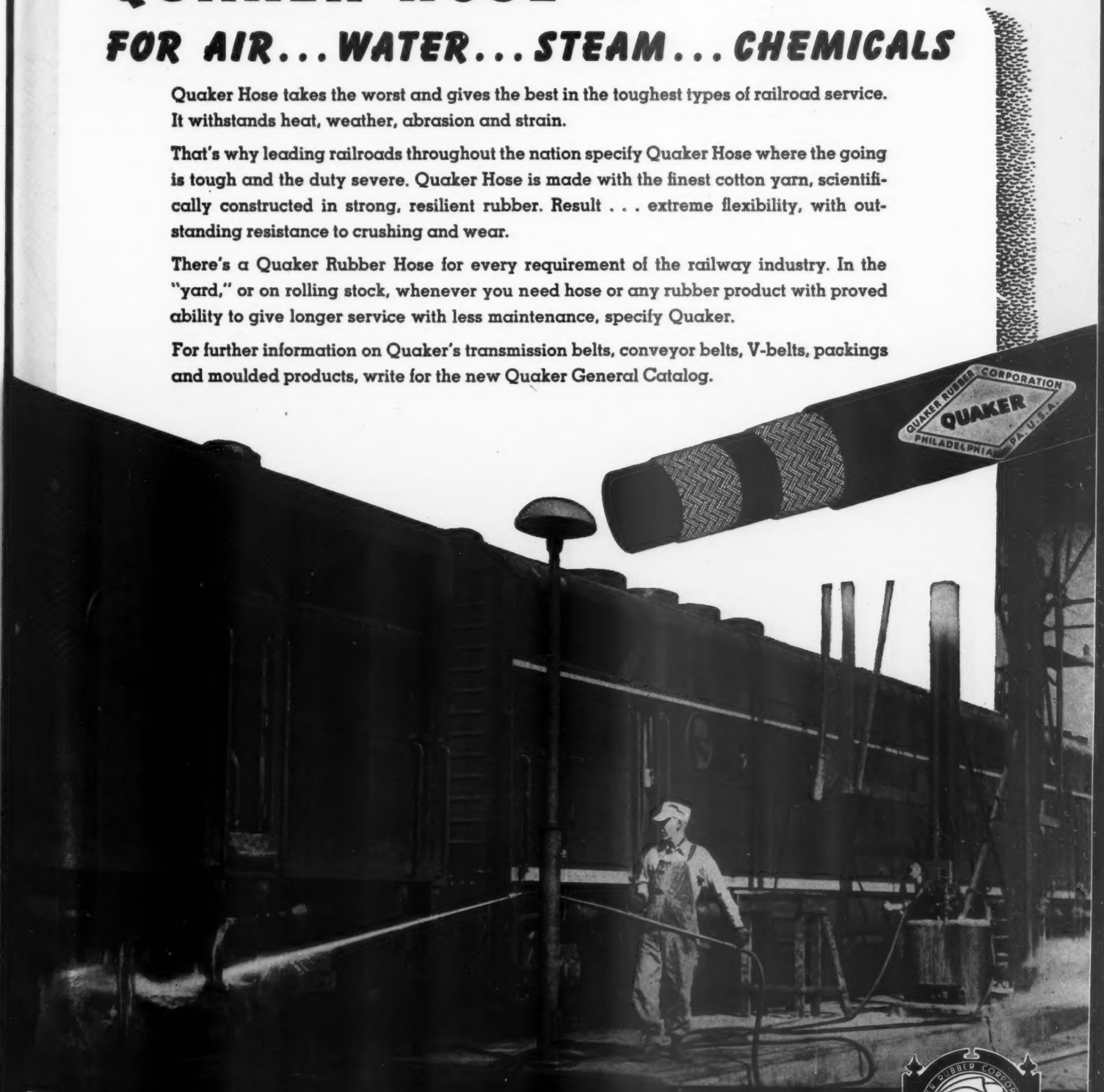
FOR AIR... WATER... STEAM... CHEMICALS

Quaker Hose takes the worst and gives the best in the toughest types of railroad service. It withstands heat, weather, abrasion and strain.

That's why leading railroads throughout the nation specify Quaker Hose where the going is tough and the duty severe. Quaker Hose is made with the finest cotton yarn, scientifically constructed in strong, resilient rubber. Result . . . extreme flexibility, with outstanding resistance to crushing and wear.

There's a Quaker Rubber Hose for every requirement of the railway industry. In the "yard," or on rolling stock, whenever you need hose or any rubber product with proved ability to give longer service with less maintenance, specify Quaker.

For further information on Quaker's transmission belts, conveyor belts, V-belts, packings and moulded products, write for the new Quaker General Catalog.



QUAKER RUBBER CORPORATION

DIVISION OF H. K. PORTER COMPANY, INC.

PHILADELPHIA 24, PENNA. BRANCHES IN PRINCIPAL CITIES

NEWS

D.P.A. Announces C.M.P. Allotments For 1st Quarter

THE railroad program has been allotted 1,640,750 tons of steel, 86,360,000 lb. of copper and copper base alloys, and 6,000,000 lb. of aluminum under the Controlled Materials Plan for the first quarter of 1952, according to Manly Fleischmann, administrator of the Defense Production Administration.

A statement issued later by N.P.A. said that the allotments would permit production in the first quarter of the following 18,000 domestic freight cars; 2,000 domestic tank cars; 250 domestic industrial cars; 1,200 freight cars for export; 636 domestic locomotives; 60 locomotives for export; 50 industrial locomotives; 54 Army locomotives; and 332,000 tons of rail for maintenance, repair and operating supplies.

The statement said this program had been outlined by N.P.A. officials at an October 16 meeting with the advisory committees representing the railroads and the contract car builders. The first-quarter allotments represent a reduction from those of the current quarter which contemplate production of 27,000 cars, including 2,500 tank cars.

"It was reported that orders for about 150,000 tons of materials allotted to the railroad industry could not be placed on mill schedules during the fourth quarter. N.P.A. said its Railroad Equipment Division has appointed an expediter to help manufacturers place authorized controlled materials orders.

Dieselization of Railroads Has Reached Half-Way Point

A QUIET industrial revolution, begun in 1924, has made such progress that dieselization of American railroads has reached the half-way point, the Society of Automotive Engineers National Diesel Engine meeting at Chicago, October 29-30, was informed by E. K. Bloss, mechanical superintendent, Boston & Maine, Boston. Mr. Bloss reported that about 14,000 diesel locomotives producing a total of 17,500,000 installed horsepower now are operating on American railroads, producing more than 40 per cent of total train-miles and 60 per cent of yard switching. He said the revolutionary trend started in 1924, when two locomotives were placed in switching service to eliminate the smoke nuisance in large-city railroad yards.

The S.A.E. held three national meetings at Chicago simultaneously, the Diesel Engine and the Fuels and Lubricants meetings convening in the Drake, and the Transportation meeting in the Hotel Knickerbocker. Engineers attending the three meetings assembled at the Drake for a joint dinner October 30, addressed by C. F. Kettering, director, General Motors Corporation on the subject "Future Energy Supply."

Railroaders demand much of diesel-electric locomotives, Mr. Bloss explained, including tremendous power output, fuel capacities for a week's operation without replenishing, satisfactory functioning regardless of altitude, heat, or cold and ability to operate continuously with minimum simple repairs or adjustments. He said the locomotives are expected to serve long, fast runs in level areas at high sustained speeds, climb mountain grades with peak power production for prolonged periods, and then suddenly change to switching service with its prolonged periods of idleness and sudden, brief demands for full power.

(*Continued on page 112*)

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of July 1951	Month of July 1950	7 months ended with July 1951	7 months ended with July 1950
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	22,471	28,800	180,267	194,149
3-06	Total, Diesel-electric	22,627	17,660	151,227	115,356
3-07	Total, electric	767	803	5,729	5,646
3-04	Total, locomotive-miles	45,866	47,271	337,244	315,182
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,610	1,640	11,955	10,680
4-06	Empty, total	851	855	6,020	5,758
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	38,785	47,800	310,617	316,052
6-02	Total in oil-burning steam locomotive trains	11,444	14,071	84,724	84,317
6-03	Total in Diesel-electric locomotive trains	62,103	50,076	421,940	325,182
6-04	Total in electric locomotive trains	2,024	2,150	15,650	14,829
6-06	Total in all trains	114,361	114,127	833,033	740,522
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.04	1.05	1.04	1.05
10-02	Loaded freight car-miles	38.90	38.90	39.40	37.90
10-03	Empty freight car-miles	20.50	20.20	19.80	20.40
10-04	Total freight car-miles (excluding caboose)	59.40	59.10	59.20	58.30
10-05	Gross ton-miles (excluding locomotive and tender)	2,762	2,704	2,744	2,625
10-06	Net ton-miles	1,287	1,232	1,283	1,183
12	Net ton-miles per loaded car-mile (M-211)	33.10	31.70	32.60	31.30
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	65.40	65.70	66.50	65.00
14	Averages per train hour (M-211):				
14-01	Train miles	17.10	17.10	17.00	17.00
14-02	Gross ton-miles (excluding locomotive and tender)	46,520	45,681	45,891	44,084
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	42.90	45.20	45.70	43.60
14-02	All	40.80	42.30	43.50	40.60
15	Average net ton-miles per freight car-day (M-240)	884	882	944	824
17	Per cent of home cars of total freight cars on the line (M-240)	39.30	38.00	37.00	44.30

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

3	Road motive-power miles (000):				
3-05	Steam	9,855	12,377	73,981	80,613
3-06	Diesel-electric	16,828	15,164	111,663	99,486
3-07	Electric	1,640	1,640	11,336	11,157
3-04	Total	28,322	29,181	196,980	191,257
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	278,312	281,257	1,908,684	1,833,835
4-09	Total in coal-burning steam locomotive trains	50,053	64,680	386,910	411,667
4-10	Total in oil-burning steam locomotive trains	35,016	39,434	234,631	249,759
4-11	Total in Diesel-electric locomotive trains	176,141	160,092	1,166,750	1,052,463
12	Total car-miles per train-miles	9.68	9.52	9.54	9.37

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,061	1,357	8,748	9,699
1-02	Steam, oil-burning	218	259	1,677	1,623
1-03	Diesel-electric[1]	2,926	2,525	20,272	16,657
1-06	Total	4,228	4,166	30,878	28,160
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	41	56	343	421
2-02	Steam, oil-burning	13	13	91	90
2-03	Diesel-electric[1]	248	234	1,683	1,565
2-06	Total	335	339	2,351	2,312
3	Hours per yard locomotive-day:				
3-01	Steam	6.90	7.90	7.90	7.70
3-02	Diesel-electric	16.60	17.10	17.30	17.20
3-05	Serviceable	13.70	13.80	14.40	13.80
3-06	All locomotives (serviceable, unserviceable and stored)	11.70	11.80	12.40	11.50
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.81	1.75	1.78	1.82
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.75	0.75	0.76	0.78

[1] Excludes B and trailing A units.

● The Erie Railroad is known as "The Route of the Perishables," carrying fresh foods to New York's millions. The key to Erie's streamlined, perishable-handling system is their hot-shot fruit express "NY-98."

This famous train highballs through the night over rugged terrain, with brief stopovers for re-icing, in time for New York markets. Hauling this 130-car, fast freight are 6,000 h.p. Diesels, lubricated with Sinclair Gascon Oil, for clean, smooth, dependable operation.

Practically all of America's top railroads have discovered they can get the last word in long, reliable service from their costly Diesels — with Sinclair Gascon® Oils.

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SINCLAIR

(*Continued from page* 108)

Insisting that the diesel locomotive is meeting the difficult requirements of modern railroading and that the trend to dieselization will continue, Mr. Bloss said that some improvements must be made. Among these he listed provision for fast warm-up, prevention or reduction of oil leaks, protection against rain, snow, dirt, and dust, and ready accessibility to facilitate maintenance.

U.P. Plans $5.6 Million Diesel Repair Shop

WORK has begun on a new main diesel repair shop for the Union Pacific at Salt Lake City, Utah. The structure has been estimated to cost $5.6 million. It is being erected on the approximate site of a dismantled engine house.

The building will include all equipment and machinery necessary for maintenance and repair of both diesel and gas-turbine-electric locomotives. The main structure will be 410 ft by 162 ft and there will be two wings, one 220 ft by 102 ft and the other 303 ft by 80 ft. The building will have five different elevations ranging from 25 ft to 65 ft in height. It will be built of reinforced concrete, concrete blocks and glass blocks.

Basic shop equipment will include a 250-ton overhead crane capable of lifting the gas-turbine locomotives (which are heavier than present diesel units) and a 90-ton drop-pit table. There will be seven servicing tracks equipped with elevated platforms at engine floor level and depressed pits below the tracks.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE NOVEMBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horsepower	Service	Builder
Florida East Coast	5[1]	1,500	Freight	Electro-Motive
Seaboard Air Line	10[2]	....	.....	Baldwin-Westinghouse
Southern	100[3]	....	.....	Alco-G. E.; Baldwin-Westinghouse: Electro-Motive
Spokane, Portland & Seattle	8[4]	1,600	Road switch	Alco-G. E.

STEAM LOCOMOTIVE ORDERS

Road	No. of locos.	Type	Builder
Norfolk & Western	15[5]	0-8-0	Company shops

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Barrett Div., Allied Chemical Dye Corp.	100	12,500 gal. tank	American Car & Fdry.
Chicago, Burlington & Quincy	2,500[6]	50-ton box	Company shops
	750[6]	70-ton hopper	Company shops
Chicago, Rock Island & Pacific	200[7]	70-ton covered hoppers	Pullman-Standard
Great Northern	95[8]	Flat	Company shops
	15[8]	Caboose	Company shops
Missouri-Kansas-Texas	500	70-ton hopper	Pressed Steel
New York Central	6[9]	125-ton flat	Despatch Shops
	4[9]	170-ton flat	Despatch Shops
New York, Susquehanna & Western	35	50-ton PS-1 box	Pullman-Standard
Union Tank Car Co.	400	50-ton tank	Company shops

FREIGHT-CAR INQUIRIES

Western Maryland	750	55-ton hopper	
	250	50-ton box	

[1] Approximate cost $888,140. Delivery scheduled for this month.
[2] Approximate cost $1,182,000. Delivery scheduled for the first quarter of 1952.
[3] Delivery expected during 1952.
[4] Estimated cost, $1,185,160. Delivery scheduled for January.
[5] To cost approximately $1,500,000. Delivery scheduled to begin during the second quarter of 1952.
[6] Production and delivery contingent on availability of materials.
[7] Estimated cost $1,400,000. Delivery expected about October, 1952.
[8] Caboose cars, completed in October, cost approximately $131,000. The flat cars, to be delivered this month, cost approximately $20,000.
[9] The smaller cars, to cost $170,010, scheduled for delivery in March and April. The larger cars, to cost $174,928, scheduled for delivery in April and May.

NOTES:

Chesapeake & Ohio.—The board of directors of the C & O has authorized purchase of 1,000 hopper cars at an approximate cost of $6,000,000.

Fruit Growers Express Company.—The company is considering purchase of 1,000 50-ton refrigerator cars.

Great Northern.—The Great Northern has received authority from its board of directors to purchase 26 new diesel locomotives, comprising 47 units, at a total cost of $8,150,000. The units authorized include 15 1,500-hp. road-switchers, two 3,000-hp. road passenger, seven 4,500-hp. road freight, one 3,000-hp. for freight and one 6,400-hp. road freight locomotive.

Louisville & Nashville.—The L. & N. has not ordered 250 50-ton box cars, as erroneously reported in the November table of orders, page 142.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	.....	.....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929

SUPPLY TRADE NOTES

KOPPERS COMPANY—*Don C. Smith* has been appointed Pittsburgh district sales manager of the Koppers Company's Wood Preserving division. He is succeeded as sales manager of the division's New York area by *Don F. Taylerson*, who has been a sales representative in the Pittsburgh district office.

◆

NATIONAL CARBON COMPANY.—*Adger S. Johnson*, formerly vice-president and general manager of the National Carbon Company, a division of the *Union Carbide & Carbon Corp.*, has been named president.

Mr. Johnson was born in Charleston, S. C. He is a 1928 graduate of the Virginia Polytechnic Institute with a degree in chemical engineering. Upon graduation he joined National Carbon and in 1933 was assigned to the company's Eveready battery plant in Shanghai, China. He was appointed superintendent of the plant in 1939 but later in that year was recalled to the United States and worked as superintendent at several National Carbon plants. He was appointed assistant to the vice-president in charge of production in 1944, vice-president in charge of foreign plants in 1948, and vice-president and general manager in 1950.

◆

AMERICAN LOCOMOTIVE COMPANY—*Paul N. Strobell*, formerly eastern district manager for Alco-GE locomotive sales and field service, has been appointed assistant to W. A. Callison, vice-president of eastern regional sales, with headquarters at New York. *Ralph M. Darrin, Jr.*, succeeds Mr. Strobell at Schenectady, N. Y. *Frederick Townsend* has been appointed assistant manager, Alco-GE locomotive sales and field service for field service, with headquarters at Schenectady, and *Richard B. Fairman* has been appointed regional renewal parts manager, eastern section, northeast regional renewal parts office, also at Schenectady.

◆

COFFING HOIST COMPANY—*J. R. Coffing*, has been elected vice-president in charge of sales, advertising and general office administration, of the Coffing Hoist Company, Danville, Ill. Mr. Coffing formerly was general sales manager.

◆

SHERWIN-WILLIAMS COMPANY—Sherwin-Williams has created three new transportation sales territories: Northern California, southern California and Ohio-Michigan. *W. R. Clark* has been appointed transportation sales representative for the Ohio-Michigan area, with headquarters in Cleveland. *E. S. Dean* will have charge of the

ON MET-L-WOOD (METAL BONDED TO PLYWOOD) USES

MAJOR manufacturers of diesel locomotives use Met-L-Wood doors and exterior side panels for the same reasons, listed at right, that make Met-L-Wood the ideal construction material for many additional railroad uses. Interior panels, bulkheads, heading, wainscoting, doors, luggage shelves, cabinets, table tops, baggage-car messenger accommodation units...All gain beauty, strength and utility when they are made lighter with Met-L-Wood.

Met-L-Wood versatility extends to the materials from which it is made. A large variety of woods, metals, thicknesses and finishes are available in stock sizes and units; or prefabricated to most exacting specifications. Write for 12-page Bulletin, describing Met-L-Wood possibilities fully.

These are the Advantages of MET-L-WOOD for Railroad Uses

- **WEIGHT SAVINGS** with Met-L-Wood are as high as 73% over steel construction of equal strength!
- **STIFFNESS** of Met-L-Wood Type 2P2-⅜" thickness is the same as that of solid steel plate ¼" thick!
- **INSULATION** and **SOUND-DEADENING** qualities of Met-L-Wood cut costs and deadweight still further by making less insulation material necessary.
- **INHERENT BEAUTY** of Met-L-Wood's smooth, tough surfaces adds aesthetic value to rugged durability.
- **FAST ASSEMBLY** of prefabricated Met-L-Wood doors and panels cuts manufacturing costs without sacrificing quality. Standard Met-L-Wood sections can be formed, sawed, tapped, drilled, brazed or soldered without special tools or skills.

MET-L-WOOD CORPORATION

6755 West 65th Street, Chicago 38, Illinois

MET-L-WOOD • *STRONG...LIGHT...Smooth Finish...Sound Deadening...Fire-Resisting...Insulating*

northern California area, working out of Oakland, and the southern California territory will be under *T. A. Jordan*, in Los Angeles.

◆

DEVILBISS COMPANY—*D. V. Perry*, eastern district manager of the DeVilbiss Company, has been named assistant sales manager of the company's spray painting and finishing division at Toledo. *C. B. Gracely*, manager of the DeVilbiss office at Houston, has been appointed eastern district manager, with headquarters at Newark, N. J. Mr. Gracely will supervise sales activities in the eastern territory which includes the New England States, New York, New Jersey, Delaware, Maryland, the eastern part of Pennsylvania and a large section of Virginia.

D. V. Perry

C. B. Gracely

◆

AIR-MAZE CORPORATION—The Air-Maze Corporation, Cleveland, Ohio, has purchased the *Detroit Air Filter Company*, Woodstock, Ill.

◆

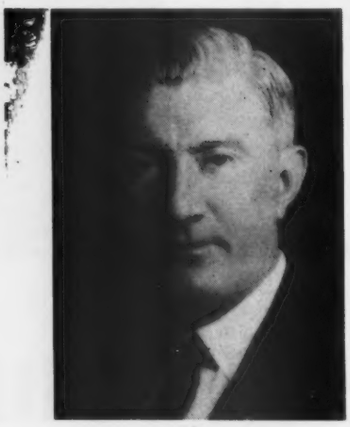
AMERICAN BRAKE SHOE COMPANY.—*William M. Black* has been named president, and *Joseph L. Mullin* vice-president, of Electro-Alloys Division, American Brake Shoe Company. Walter G. Hoffman, formerly president of Electro-Alloys Division has been appointed assistant to the vice-president for Research and Development at Mahwah, N.J. Mr. Mullin will continue also as vice-president in charge of operations for the Manganese Steel Division of the Company.

◆

DEARBORN CHEMICAL COMPANY, LTD.—*Dr. William A. James* has been appointed director of research, and *Jerry Shaw* as sales representative of Dearborn Chemical Company, Ltd. Dr. James will assume charge of all research activities at the Dearborn laboratories, 2454 Dundas street, west, Toronto. For the time being Mr. Shaw will also have headquarters at Toronto.

◆

NATIONAL STEEL CAR CORPORATION—*A. Van Hassel*, a vice-president and director of the National Steel Car Corporation, Hamilton, Ont., since 1942, has been elected president to succeed the late *Robert S. Hart*. *O. H. Anderson*, chief mechanical engineer since 1925 and a vice-president since 1942, has been elected a director and also has been appointed managing director. Mr. Van Hassel also is president of the Magor Car Corporation of New York.



A. Van Hassel

◆

CHICAGO STEEL SERVICE COMPANY—The Chicago Steel Service Company has opened new general offices and warehouse at Kildare avenue and 45th street, Chicago. The one-story steel frame structure covers 120,000 sq. ft. and cost $1,500,000 to build.

◆

GUSTIN-BACON MANUFACTURING COMPANY—Gustin-Bacon has opened a new sales office and warehouse facility in Houston, Tex., at 5531 Armour Drive. The new warehouse will house Houston division operations of the company's oil field, industrial, insulation and fire fighting equipment business. *Paul O. Craig* has been appointed manager of the Houston division, and *H. M. Stone* will continue as branch manager there.

◆

LANDIS TOOL COMPANY.—The Detroit branch office of the Landis Tool Company, Waynesboro, Pa., has been moved to 17151 Wyoming avenue, Detroit 21.

The former address was 411 New Center building.

RAILWAY TRUCK CORPORATION—*Clarence W. Osner* has become associated with the sales department of the Railway Truck Corporation at Chicago.

◆

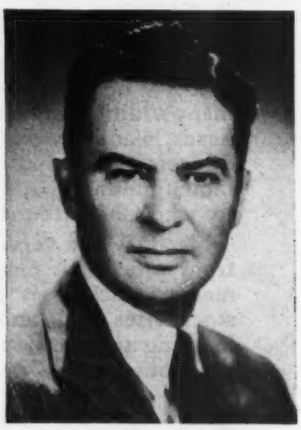
VAPOR HEATING CORPORATION.—*J. T. Elwood*, who has been appointed sales representative of Vapor at Chicago as announced in the November issue succeeds *Dave J. Jones*, deceased. Mr. Elwood will handle sales of Vapor-Clarkson steam generators and other equipment the company makes for the locomotive builders.

J. T. Elwood

Mr. Elwood has been with Vapor tor ten years except for service time as a Navy flying officer, and has worked with railroads all over the country out of the company's Chicago office, St. Louis, and Houston.

◆

FAIRBANKS, MORSE & CO.—*D. C. Prescott*, formerly St. Louis district manager of locomotive sales for Fairbanks, Morse & Co., has been appointed middle western regional sales manager, with headquarters at Chicago. His territory will include St. Paul, Minneapolis and St. Louis. Mr. Prescott was with the Baldwin-Lima-Hamilton Corporation and the Union Pacific before he joined Fairbanks, Morse in 1949.



D. C. Prescott

◆

HOMESTEAD VALVE MANUFACTURING CO.—*Railroad Supply & Equipment, Inc.*, has been appointed exclusive distributor of

use *genuine* BALDWIN DIESEL PARTS

BALDWIN DIESEL CYLINDER LINERS are chrome plated to give extra service. Little wonder users report finer performance and longer wear—frequently four times normal. Seven conveniently located warehouses offer fast service on these cylinder liners as well as on other Baldwin Diesel Parts.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

PHILADELPHIA 42, PA. • OFFICES IN PRINCIPAL CITIES

Emergency! Plastic tape saves charred motor leads

Burned and blistered motor leads—cracked wide open, and no replacement trucks available! How to get the big road Diesel back on the job fast? Strip down the leads and wrap with "SCOTCH" No. 33 Electrical Tape. That's what Rock Island electricians did recently, and the results were surprising.

The tape, applied in an emergency, lasted through 300,000 miles of continuous service—even in a 90 mph undercar air blast. Never a single failure.

This same stick-at-a-touch tape safeguards hundreds of other installations, too. Plastic backing is unaffected by water, oil, alkalies, acids, weathering. Dielectric strength of 10,000 volts gives extra high insulation protection, yet tape is super-thin for neat, compact results.

Try it today and see! Your jobber can supply you.

ASK FOR FREE BOOKLET E-RR. See how you can save with the *right* tape for the job! For your copy, write: Minnesota Mining & Manufacturing Co., Dept. RM-121, St. Paul 6, Minnesota.

SCOTCH BRAND
Electrical Tape
No. 33

The term "SCOTCH" and the plaid design are registered trademarks for the more than 100 pressure-sensitive adhesive tapes made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives.
General Export: Minnesota Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y.
In Canada: Minnesota Mining & Mfg. of Canada, Ltd., London, Canada.

the Homestead company's Hypressure Jenny steam cleaner.

◆

AMERICAN CAR & FOUNDRY CO.—*Robert M. Hoel,* has been appointed sales agent for the American Car & Foundry at Chicago, reporting to J. H. Van Moss, western sales manager. Mr. Hoel, who has been with the company's sales department since

R. M. Hoel

1946, will represent the company in general railroad sales throughout the midwest.

Joseph T. McNally who has been appointed sales agent in the New York district sales office. Mr. MmNally formerly worked for the Shippers' Car Line Corporation and the American Welding Com-

J. T. McNally

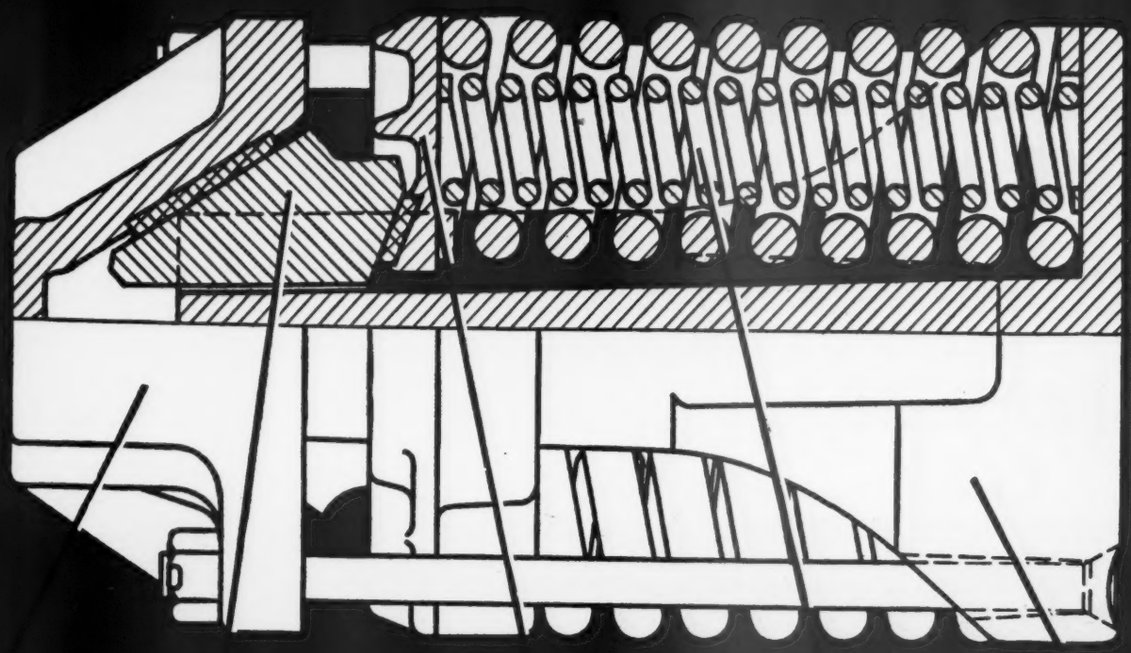
pany, both A.C.F. subsidiaries. He has been assistant manager of tank car sales for the parent company since 1946 and in his new position will specialize in tank-car and miscellaneous sales.

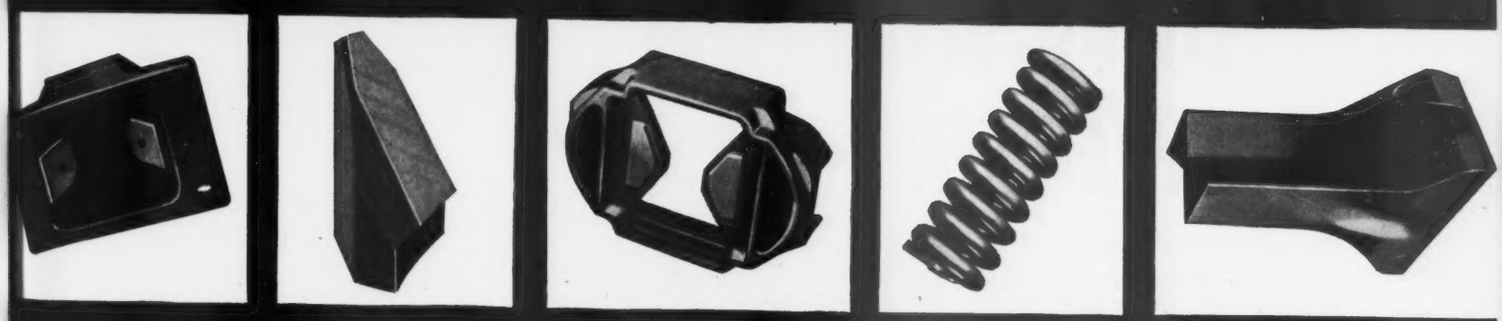
◆

AIR-MAZE CORPORATION—The Air-Maze Corporation, Cleveland, Ohio, has purchased the *Detroit Air Filter Company* of Woodstock, Illinois. The manufacture of Detroit, Arco and Dustay filters will be continued at Woodstock.

◆

TURCO PRODUCTS, INC.—*Archie K. Beard* has been appointed midwest sales manager of Turco Products. Mr. Beard, formerly district manager in Cleveland,, has been transferred to Chicago, where the organization's Chicago-Cleveland operation will now be consolidated. *Harold P. Glavin*





Why the National M-17-A is outstanding!

...Report No. 950 on AAR Five and Twelve Year Tests

● Our Report No. 950 (taken from Circular No. DV-1215, nnual Report of the AAR Committee on Couplers and Draft ears) gives in detail some of the success of the National -17-A Friction Draft Gear. A brief summary of the AAR Com-ittee's conclusions shows how this gear gives outstanding rformance in providing maximum car protection.

The report points out that in both the five and twelve ar tests "externally these gears appeared in good shape... ternally there was no detectable wear... the wedging rfaces were all nicely polished... friction surfaces all had nearly 100% contact and all surfaces were fairly straight."

And the report shows that after twelve years of service, the average capacity of the gears tested was still 37% above the AAR minimum of 18,000 foot-pounds required of new gears.

The National M-17-A gear stood up well on these tests because of its rugged design of inwardly acting wedge pressure against a centrally located friction member. Alloy steel castings with machined, ground and hardened friction surfaces assure accurate fit and long wear life.

A-3938

Write today for your copy of Report Number 950 on AAR *e and twelve year tests:* **National Malleable & Steel Castings Company,** **600 Quincy Avenue, Cleveland 6, Ohio.**

NATIONAL Products

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

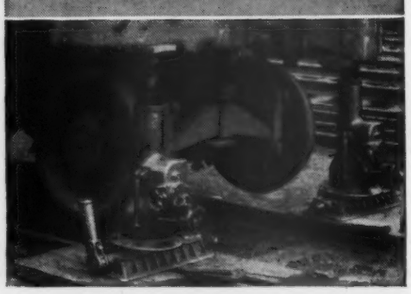
TRUCKS ● YOKES ● DRAFT GEARS ● JOURNAL BOXES AND LIDS

FOR QUICK—ECONOMICAL

RERAILING of LOCOMOTIVES and RAILROAD CARS

DUFF-NORTON TRAVERSING BASES

Emergency rerailing of Diesel, steam, electric locomotives and railroad cars . . . is safe, simple and low in cost, with Duff-Norton Traversing Bases. Carried on wreck trains in units of two bases and two jacks, they eliminate the need for expensive cranes and are always available for any rerailing job.



Traversing Bases and Jacks are placed under load. for rerailing locomotives and cars.

QUICK DATA ON TRAVERSING BASES

Jack No.	Capacity Tons	Height Inches	Horizontal Travel Inches	Weight Pounds	Size of Plate Inches
39-TB	35	3¾	15	85	12 dia.
*40-TB	50	4	15	106	10 x 12
41-TB	50-75	4	20	140	14 dia.

*No. 40-TB can also be furnished for 26" horizontal movement on special order.

No. 40-TB furnished with wooden operating lever 1⅞" x 24" long.

Nos. 39-TB and 41-TB supplied with steel operating lever 1" x 24" long.

Freight car is lifted and moved horizontally until wheels are aligned with rails. Jacks are lowered to complete rerailing job.

For Jacks Used With Traversing Bases . . . Write for Your Copy of Bulletin AD-4-R.

DUFF-NORTON JACKS — STRENGTH, SAFETY, DURABILITY — ESTABLISHED 1883

THE DUFF-NORTON MANUFACTURING CO.

Main Plant and General Offices, PITTSBURGH 30, PA. Canadian Plant, TORONTO 6, ONT.

"The House that Jacks Built"

has been appointed general manager, Midwest Division factory of Turco, with headquarters in Rockdale, Ill.

Mr. Beard joined Turco as a technical service engineer in September 1945 and assumed the Cleveland district managership in January 1948. He is a graduate Chemical Engineer from Arizona State Col-

A. K. Beard

lege and the University of Southern California. He spent six years as an instructor of Physics and Chemistry at Jerome, Ariz., High School, and during World War II was supervisor of the Chemical and Metallurgical Laboratory for the Goodyear Aircraft Company.

◆

BALDWIN-LIMA-HAMILTON CORPORATION. —*H. A. Nielsen,* has been placed in charge of the new Los Angeles sub-office recently opened by the Baldwin-Lima-Hamilton Cor-

H. A. Nielsen

poration in the Pacific Electric building, 610 South Main Street. Mr. Nielsen formerly was assistant to the district manager at San Francisco.

◆

GENERAL ELECTRIC COMPANY—*B. C. Tracey,* manager of accessories and renewal parts sales of the welding department of General Electric Company, has retired. Mr. Tracey joined General Electric in 1918 and was appointed manager in 1948.

◆

CUMMINS ENGINE COMPANY—*R. A. D'Amour* and *G. W. Plondke,* formerly sales engineers for the Cummins Engine

Lasts as long as the car!

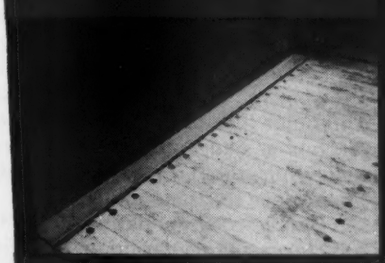
"M-F" Threshold Plate

is a structural and wear member permanently welded in place...

Threshold Plate being placed in position.

Threshold Plate welded to door post and side sill.

Floor boards being placed.



Floor boards tacked down.

"M-F" PRODUCTS

Lock Nuts • Cotter Pins

Floor Clips • Threshold Plate

The floor boards do not pass under the "M-F" Plate... a feature which greatly increases the ease of removing and replacing floor boards.

The "M-F" Threshold Plate has a formed section which is welded in place, materially strengthening the sill of a box car.

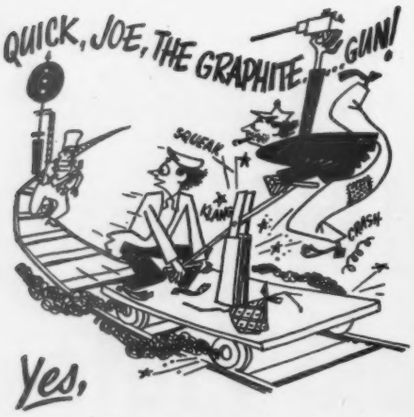
The "M-F" Threshold Plate produces a smooth and clean joint without bolt heads in the doorway.

"M-F" Threshold Plates will last as long as the car.

Floor boards are easily removed... easily replaced.

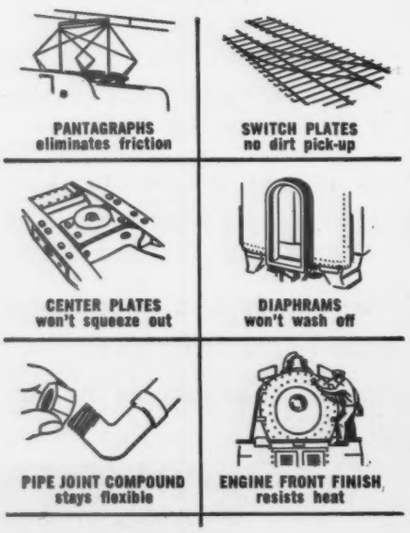
MAC LEAN-FOGG LOCK NUT COMPANY

5535 North Wolcott Avenue, Chicago 40, Illinois • ***In Canada: The Holden Co., Ltd., Montreal***



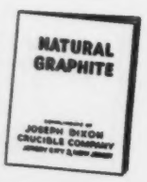
Yes, everything works better with Dixon Graphite!

FOR EXAMPLE:


PANTAGRAPHS eliminates friction
SWITCH PLATES no dirt pick-up
CENTER PLATES won't squeeze out
DIAPHRAMS won't wash off
PIPE JOINT COMPOUND stays flexible
ENGINE FRONT FINISH resists heat

Dixon *Natural* Graphite is unaffected by extremes of temperature—is inert, won't wash off or squeeze out under pressure—doesn't pick up road dirt or dust. For real operating economy use Dixon wherever you have a tough maintenance problem.

SEND FOR FREE SAMPLE of Dixon 1924—Quick Drying Lubricant. Try it—it's an effective, long lasting dry lubricant, superior to oil and grease for many applications. Also, ask for your copy of technical report "Natural Graphite." Joseph Dixon Crucible Company, Jersey City 3, N. J.



DIXON

NATURAL GRAPHITE

• 1924 Quick Drying Lubricant • Center Plate Lubricant • Graphite Seal • Pipe Joint Compound • Brake Cylinder Lubricant • Engine Front Finish • Graphite for Compounding • Lathe Center Lube

Company, Columbus, Ind., have been appointed assistant regional managers, Washington, D. C. region and Central region, respectively.

◆

PEERLESS EQUIPMENT COMPANY.—*Charles F. Palmer* has been elected president of Peerless Equipment Company, a subsidiary.

Charles F. Palmer

of Poor & Co., succeeding *William E. Gray*, who has resigned. Mr. Palmer's headquarters are in Chicago.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY—*T. H. Way*, has been appointed assistant vice-president of the

T. H. Way

Pullman-Standard. Mr. Way will have charge of manufacturing at the Hammond, Ind., and Rockford, Ill. plants.

◆

PRECO, INC.—Preco, Inc., Los Angeles, Cal., has appointed *Electra Motors*, Anaheim, Cal., to develop and supply the small electric motors and accessory equipment, such as pulleys and V-belts, used in precooling refrigerator cars equipped with Preco fans.

◆

DEDNOX, INC.—*Constant C. Hopkins*, owner of the *Constant Hopkins Company*, has been elected vice-president of Dednox, Inc. *Michael W. Neal*, who has been head of the Dednox service department, has been appointed sales engineer. Together they will collaborate with the *Spring Packing Corporation*, exclusive distributor of Dednox to railroads. Mr. Hopkins has

below 800° F.

Accurate TEMPERATURE READINGS in a few seconds . . .

XACTEMP

Low Temperature · General Purpose

HAND PYROMETER

Type LT-840 Low temperature Xactemp Pyrometer with rigid extension arm and surface tip thermocouple.

1001 USES

This is the answer to quick, accurate temperature readings below 800° F. in many industrial processes and operations. And it's so convenient to handle.

The Xactemp hand-type pyrometer, Model LT-840, is used with needle thermocouples, ribbon thermocouple, surface tip thermocouple, and other specially designed thermocouples and extension arms. These are easily interchangeable and, without adjustments or recalibration of the instrument, quickly ready it for measuring the surface temperature of stationary and revolving rolls and cylinders, flat and irregular surfaces of molds, dies, etc. in rubber and paper making, plastic materials, rubber, wax, oils, greases, and other semifluid materials.

Handy, compact design makes this Xactemp pyrometer ideal for field service, laboratory, and production-line use.

***Price** Xactemp Pyrometer less thermocouples $51.50*

Write for detailed, descriptive literature on Gordon Xactemp Pyrometers.

GORDON SERVICE

CLAUD S. GORDON CO.

Manufacturers & Distributors

Thermocouple Supplies • Industrial Furnaces & Ovens
Pyrometers & Controls • Metallurgical Testing Machines
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ESSO COBLAX

"Tailor-made" to railroad specifications

The Sign of QUALITY — Esso — The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

ESSO COBLAX LUBRICANTS

have been specifically developed to provide highly dependable gear lubrication for traction motor drives on electric and diesel-electric locomotives; gas electric and multiple-unit cars; and many other locomotive and car lubrication requirements. Esso COBLAX is availabe in a wide range from fluid oils to semi-solid products... "tailor-made" for railroad applications.

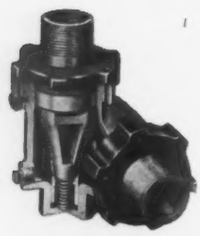
BACKED BY CONSTANT RESEARCH

—keeping pace with latest engine design and developments. Esso Railroad Products are constantly being tested and improved.

BACKED BY CONSTANT FOLLOW-UP

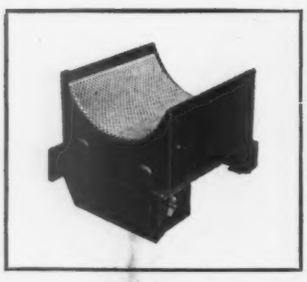
—on-the-job check-ups by Esso Sales Engineers assure dependable performance of Esso Railroad fuels and lubricants! Be sure to call on ESSO for any fuel or lubricating problem.

use Franklin parts on Franklin devices

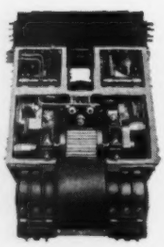


Sleeve Joints

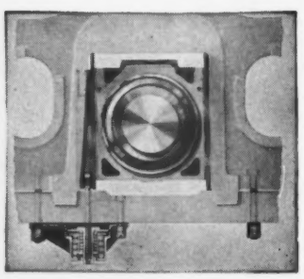
In order to obtain full efficiency from your Franklin devices, specify genuine Franklin parts in replacement. Franklin devices will always perform best when equipped with genuine Franklin parts made to interchangeable tolerances and of the correct materials.



Driving Box Lubricators

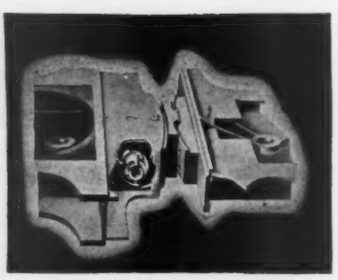


The Locomotive Booster



Automatic Compensators & Snubbers

Franklin System of Steam Distribution



Radial Buffers

Fire Doors

Power Reverse Gears

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • TULSA • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER
POWER REVERSE GEARS • FIRE DOORS • DRIVING BOX LUBRICATORS • OVERFIRE JETS
JOURNAL BOXES • FLEXIBLE JOINTS • TANK-CAR VALVE

RAILWAY DISTRIBUTOR FOR N.A. STRAND FLEXIBLE SHAFT EQUIPMENT

been associated with the sale of Dednox since its inception.

◆

STANDARD RAILWAY EQUIPMENT MANUFACTURING COMPANY—*N. H. Arnold*, has been appointed sales manager of the Stand-

H. H. Arnold

ard Railway Equipment Manufacturing Company. Mr. Arnold will be in charge of development, manufacture and sale of Standard's wheel-truing machine.

Obituary

WILLIAM T. BISSELL, of the Journal Box Servicing Corporation, died on October 8.

DONALD S. BARROWS, who retired as vice-president in charge of engineering for the Symington-Gould Corporation in 1947, died on October 27, at his home in New Haven, Conn. Mr. Barrows, who was 74 years old, joined the T. H. Symington Company, a predecessor of Symington-Gould, as chief engineer, in 1915.

PERSONAL MENTION

General

S. T. KUHN, assistant superintendent equipment of the New York Central, Lines West of Buffalo, at Chicago, has been appointed assistant to general superintendent equipment of the system at New York.

PERRY D. HAWKINS, assistant general air brake inspector of the Erie, has been appointed general air brake inspector, with headquarters as before at Cleveland.

GEORGE H. HIGLEY, general air brake inspector of the Erie at Cleveland, has retired under the pension rules of the company after more than 48 years of service.

C. B. CAMP has been appointed superintendent automotive equipment of the Chicago, Rock Island & Pacific at El Reno, Okla.

T. J. LYON, superintendent of equipment (Buffalo and East) for the New York Central at New York, has been appointed

This is the Best Diesel-Electric Traction Motor Brush Money can Buy!

Big Statement? You Bet!

BUT WE CAN BACK IT UP! Into the brush illustrated above, National Carbon Company has built plus factors which make it the finest in the world for its purpose — a brush developed especially for diesel-electric motors. Here's why:

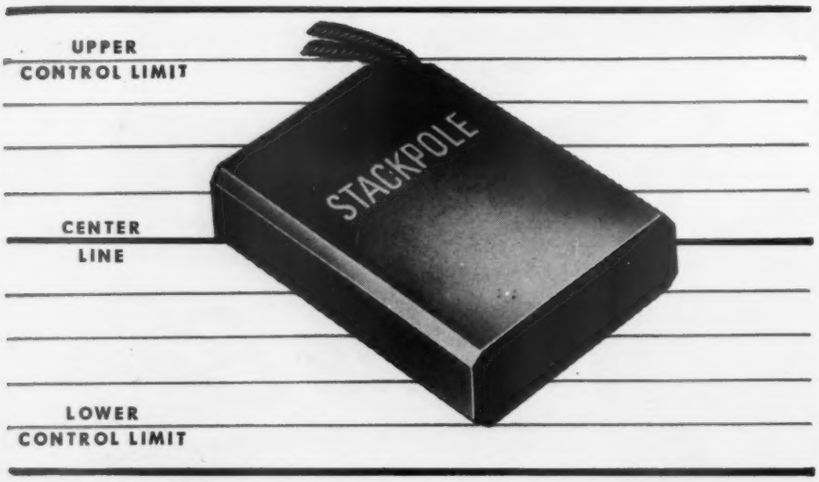
- **"NATIONAL" Grade AZY**—proved by millions of service miles to give longest life with excellent commutator condition, plus remarkable freedom from breakage!
- **"NATIONAL" Permanently-Sealed Shunt Connections** do not pull out. Of millions made to date, *not one pull-out* has ever been reported! These Permanently-Sealed Connections also minimize cable fraying through special internal construction.
- **Exclusive Fray-resistant Cable** gives still further protection, with the result that overall brush dependability is assured!

All three outstanding features available in the following "NATIONAL" STANDARDIZED Brushes

NC 24-7215 — 2 x 2¼ x ¾" (⅜-⅜)
NC 24-5620 — 2 x 1¾ x ¾" (⅜-⅜)
NC 20-6420 — 2⅛ x 2 x ⅝" (5/16-5/16)

The terms "National" and "Plytek" and the Silver Strand Cable device are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
IN CANADA: National Carbon Limited
Montreal, Toronto, Winnipeg



quality controlled...
for uniform dependability

The uniform dependability of Stackpole Diesel Brushes is the direct result of long, specialized experience PLUS statistical Quality Control in every step of production. Stackpole Quality Control means that brush characteristics are kept at highly uniform levels—long life and minimum commutator wear are assured.

STACKPOLE CARBON COMPANY
St. Marys, ● *Pa.*
Carbon-Graphite specialists for over 30 years

STACKPOLE
Diesel-Electric
BRUSHES

assistant superintendent of equipment, (West of Buffalo), with headquarters at Chicago. Mr. Lyon has been appointed also superintedent of equipment for the Indiana Harbor Belt and the Chicago River & Indiana.

GEORGE R. ANDERSEN whose appointment as assistant chief mechanical officer of the Chicago & North Western was announced in the November issue, started in 1911 as a car inspector at Milwaukee, later serving as chief car inspector and

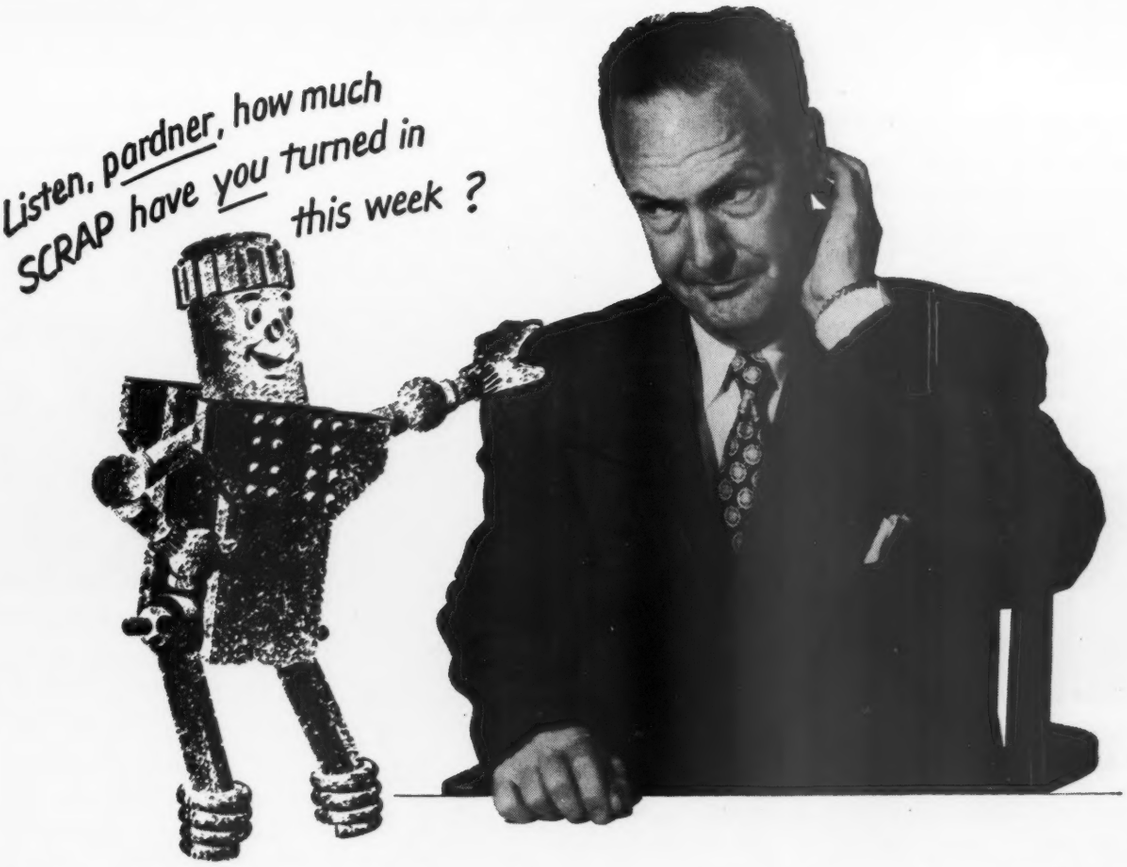
George R. Andersen

assistant car foreman. In 1920 he was appointed geneeral car foreman at Butler, Wis.; in 1921, assistant master car builder at Chicago, master car builder in 1925, assistant superintendent car department in 1942, and in 1945 superintendent car department at Chicago.

JOHN C. STUMP, whose appointment as chief mechanical officer of the Chicago & North Western was announced in the November issue, began his railroad career with the C. & N. W. in 1912 as a machinist at Eagle Grove, Iowa. He later served in various supervisory positions at Chad-

John C. Stump

ron, Neb., Green Bay, Wis., and New Butler. In 1926 he was appointed assistant superintendent of motive power and machinery at Chicago; in 1939, superintendent of motive power, Western district; in 1944, superintendent of motive power, Northern district, and in 1948, assistant chief mechanical officer.



Today, the steel business is your business

—*it needs all your SCRAP, Now!*

SUPPOSE that every steel user were suddenly told that he had to turn in a half-ton of scrap before he could get a ton of steel. It would start the most gosh-almighty treasure hunt for scrap that ever happened.

In effect, this "no-scrap, no-steel" situation virtually exists. For without *all* the scrap that industry can search out and start on its way to the mills, steel production will surely drop. It's as serious as that.

More scrap is urgently needed. Today the mills are turning out more steel than ever before. But they're scraping the bottom of the barrel as far as scrap is concerned. Defense and domestic demands for steel simply cannot be met unless at least 100,000 tons of "purchased" scrap roll into the furnaces—*every day*.

The bulk of this scrap must come from industry. That's why we're asking for your all-out help. That's why it's so important that you make the drive for scrap part of your daily operations. Make it your business to encourage every employee to report any obsolete, broken or worn-out machinery, tool or equipment that has seen its day. From this dormant "junk" must come the heavy melting scrap that the mills need most. Don't let your scrap lie idle; send it on its way. How about it, pardner?

You'll find your local scrap dealers listed in the yellow pages of the phone directory.

This page would ordinarily be used to tell you about

AMERICAN TIGER BRAND WIRE ROPE

but, because without SCRAP we cannot produce steel, we are asking instead for your all-out help in getting more SCRAP to the mills.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

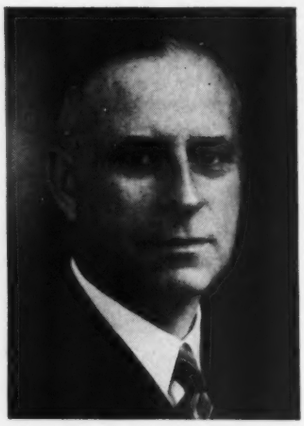
1-1328

UNITED STATES STEEL

C. H. GRAY has been appointed superintendent motive power of the Chicago Rock Island & Pacific at El Reno, Okla.

G. W. NELSON, assistant master mechanic of the New York Central at Syracuse, N. Y., has been appointed special assistant to manager equipment at New York.

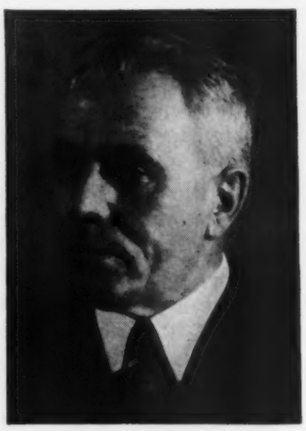
E. R. BATTLEY, chief of motive power and car equipment of the Canadian National at Montreal, has retired after nearly half a century of railroad service. Mr. Battley was born at Stratford, Ont., on October 21, 1886, and entered railroad service in December 1902 as a machinist apprentice with the Grand Trunk (now C.N.) at Stratford. He subsequently served as machinist, inspector, locomotive foreman. general foreman, master mechanic and superintendent motive power. In 1927, when union-management cooperative committees were being developed on the C.N., Mr. Battley was the machinist member of the committee of experts organized by the railway's Bureau of Economics to study the technical features of the plan which is still in operation today. In 1930 he was appointed assistant general superintendent of motive power at Toronto and in July 1932 he was loaned to the National Railways of Mexico to conduct a study of machine shops and prepare recommendations for these establishments. On his re-



E. R. Battley

turn to Canada, Mr. Battley became superintendent of shop methods at Montreal. In 1933 he was appointed general superintendent in the motive-power and car-equipment department at Toronto and in October 1942 became chief of motive power and car equipment at Montreal.

A. C. MELANSON, works manager of the Canadian National at the Point St. Charles shops at Montreal, has been appointed chief of motive power and car equipment. Mr. Melanson was born at Scoudouc, N. B., and entered railroad service with the Intercolonial (now C.N.) in 1911 as a machinist apprentice in the mechanical department at Moncton, N. B. He subse-



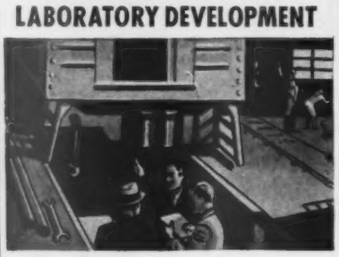
A. C. Melanson

quently served as draftsman, material inspector, and superintendent of motive power and car shops at St. Malo, Que. In February 1939 he became superintendent of motive power and car equipment of the Quebec district and in 1943 superintendent at Toronto. Mr. Melanson was appointed works manager of the Point St. Charles shops in 1944.

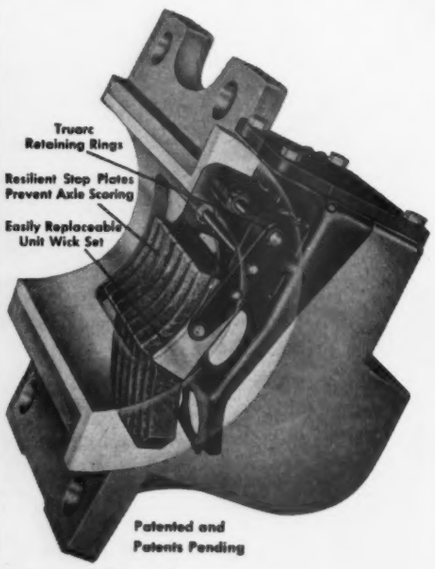
Electrical

WILLIAM C. CHAPMAN, chief electrical engineer on the Chicago & North Western,

CONTINUOUS SCIENTIFIC LABORATORY DEVELOPMENT



CONSTANT ON-THE-JOB PERFORMANCE TESTS...


Truarc Retaining Rings
Resilient Stop Plates Prevent Axle Scoring
Easily Replaceable Unit Wick Set
Patented and Patents Pending

Result! **Felpax Lubricators Reduce Support Bearing Maintenance as much as 75%**

INSTANT COMPLETE LUBRICATION with the first turn of the axle under heavy load conditions reduces babbit wipe and consequent early bearing damage. Continuous lubrication under high speeds provided by special felt wicks in constant contact with the journal insures longer bearing life.

MILLIONS OF MILES of trouble-free service on the nation's Class I Railroads have proved Felpax Lubricators provide the lubrication required to keep Today's Modern Traction Motors operating at peak efficiency.

NO OTHER LUBRICATION METHOD provides all these *"Performance Proved"* FEATURES!

- **ELIMINATES waste packing and the human element involved.**
- **SERVICE reduced to periodic checking and filling oil sump.**
- **SPECIAL FELT WICKS eliminate waste grabs and starved bearings.**
- **REPLACEMENT of worn wick sets after thousands of miles of use is simplified by improved construction (see illustration above).**
- **COMPLETE KIT for replacement containing wick set, springs and necessary hardware available at nominal cost.**
- **NO MOVING PARTS subject to failure due to dirt, moisture and freezing.**

For full particulars see your locomotive builder or write to:

MILLER FELPAX CORPORATION
WINONA, MINNESOTA

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT	RPM Delo R.R. Oil
UNIT	Locomotive diesel engines
SERVICE	Freight and passenger
OPERATION	Local and transcontinental
MAINTENANCE	Progressive

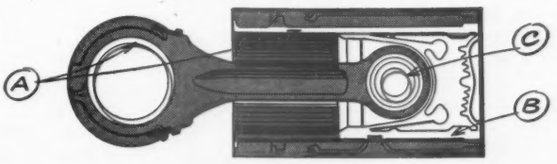
One million miles of service from engine parts!

LUBRICATED WITH RPM DELO R.R. OIL, many diesel engines in the locomotives of U.S. railroads have been in service for long periods without complete overhaul! Many of the liners, pistons, bushings and other parts in these engines have now been in use for hundreds of thousands of miles. Progressive maintenance inspections indicate that RPM DELO R.R. Oil will keep the parts in service for at least one million miles, the general overhaul period set by some of the railroads.

RPM DELO R.R. Oil keeps parts clean and free of wear-causing lacquer and gum deposits and is not corrosive to engine metals of any kind.

IN OVERLAND MOUNTAINOUS FREIGHT SERVICE for nearly 500,000 miles, this liner, lubricated with RPM DELO R.R. Oil has less than 0.006 inch wear and taper is so minor that it is barely measurable.

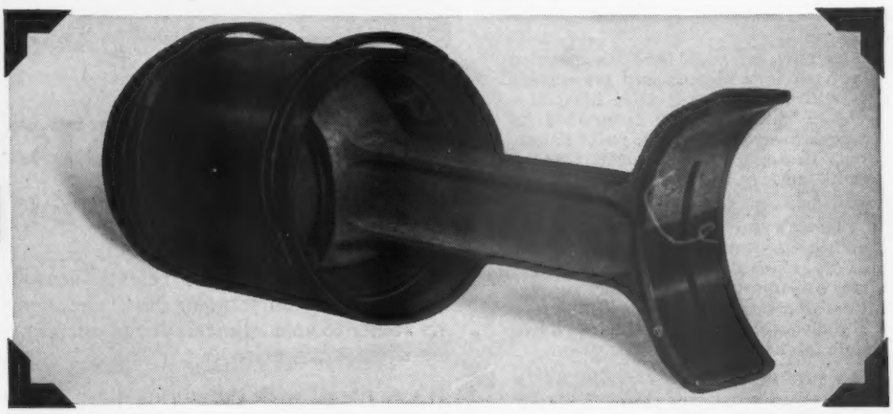
How RPM DELO R.R. Oil prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities...keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean...helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of any bushing or bearing metals and foaming in crankcase.



THIS PISTON AND CONNECTING ROD have been in service for more than four years. After picture was taken it was put back in the engine for further use. Note the excellent condition of the rings and bearing. All the rings are free, oil holes open and there are no troublesome deposits in any ring grooves.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any one of the companies listed below.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA	THE CALIFORNIA COMPANY	STANDARD OIL COMPANY OF TEXAS
225 Bush Street • San Francisco 20, California	P. O. Box 780 • Denver 1, Colorado	P.O. Box 862 • El Paso, Texas

has retired after 40 years of service. Mr. Chapman started with the company in 1911 as an electrician at Chicago. He was appointed chief electrician at Clinton, Iowa, in 1914, electrical inspector at Chicago in 1916; assistant electrical engineer in 1927; electrical engineer in 1945 and chief electrical engineer in 1947.

HAROLD T. THEIS has been appointed chief electrical engineer of the Central of New Jersey, reporting to the superintendent motive power and rolling stock. Mr. Theis' headquarters are at Jersey City, N. J.

Master Mechanics and Road Foremen

S. D. DEKLE, assistant mechanical officer of the Seaboard Air Line at Jacksonville, Fla., has been appointed master mechanic of the North Florida division, with headquarters at Jacksonville.

W. L. JONES, master mechanic of the Illinois division of the Illinois Central at Champaign, Ill., has retired after 44 years of service.

G. E. BELL, master mechanic of the Illinois Central at McComb, Miss., has been transferred to the position of master mechanic at Vicksburg.

J. G. CARLTON, master mechanic of the North Florida division of the Seaboard Air Line at Jacksonville, Fla., has been transferred to the Georgia division at Atlanta (Howells), Ga.

R. W. ELLIS, general master mechanic of the Iowa division of the Illinois Central at Waterloo, Iowa, has been appointed master mechanic at Champaign, Ill.

R. W. BALLARD, diesel supervisor of the Illinois Central System at Chicago, has been appointed master mechanic at Jackson, Tenn.

A. BLANKINSHIP, general foreman of the Illinois Central at Johnston shop, Memphis, Tenn., has been appointed to fill the newly created position of master mechanic of the Kentucky division, with headquarters at Paducah, Ky.

V. V. VIAR, general foreman of the Chesapeake & Ohio, Hinton, W. Va., has been appointed master mechanic of the Hinton division.

E. L. WALSTON, general foreman of the Illinois Central at East St. Louis, Ill., has been appointed general master mechanic of the Iowa division with headquarters at Waterloo, Iowa.

C. L. HALL has been appointed assistant master mechanic of the New York Central at Harmon, N. Y.

VERNON I. MARLO, superintendent of shops of the Atchinson, Topeka & Santa Fe at Barstow, Cal., has been transferred to the position of master mechanic at Argentine, Kan.

W. H. CHIDLEY, master mechanic of the New York Central at Albany, N. Y., has been transferred to New York.

(*Continued on p. 134*)

CLEAN
Diesel-Electric Motors
Without Solvents

NO Drying Periods, NO Toxic Hazards with NEW Pangborn AC-4 Blast Machine

The new, fast, safe and inexpensive way to clean motors and generators is with a Pangborn AC-4 Blast Machine. Soft, 20-mesh corncob grits whisk away grease, oil, paint flakes, etc., in scouring armatures, frames, coils and other parts. (See photo above.)

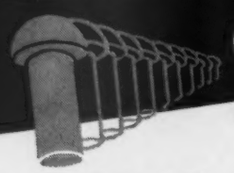
There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

FOR FULL INFORMATION write today and tell us what you clean. Address: PANGBORN CORP., 3700 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn
BLAST CLEANS CHEAPER
with the right equipment for every job

PROPERLY HEATED RIVETS at a SAVING!



with a JOHNSTON RIVET FORGE!

Save oil, save time, cut costs! The Johnston Rivet Forge is outstanding for its economy, for its ability to hold adjustment and operate steadily without attention.

It's equipped with the proven Johnston non-clogging vacuum oil burner. Because it's engineered with experience there's no oil valve—no small passage to clog! It's available in portable or stationary types. For safety, for dependability, for economy, order the Johnston Rivet Forge!

Write For Bulletin R-801

Over Thirty Years Experience in Design and Manufacture of Burners • Blowers • Furnaces • Rivet Forges • Fire Lighters • Tire Heaters • And Allied Equipment

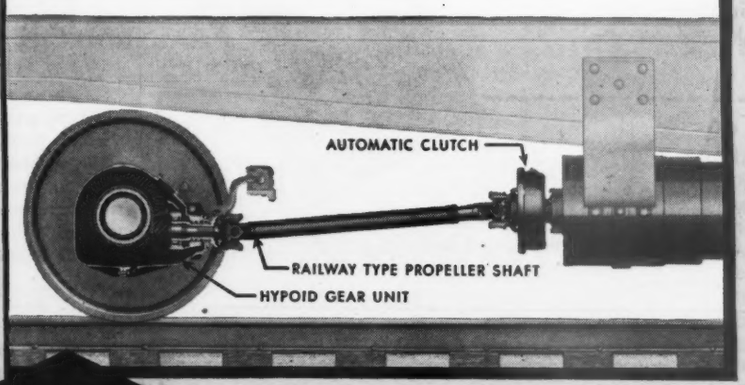
THE JOHNSTON LINE — SAFETY OF DEPENDABILITY
JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE
MINNEAPOLIS 13, MINN
ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

MORE THAN 8000 SPICER *Positive* GENERATOR DRIVES

in operation on 70 different railroads!

The Spicer Railway Generator Drive for lighting, air-conditioning, refrigerating and other electrical equipment consists of a very simple application of long-lived hypoid gear and pinion mounted on the standard axle. The drive from the gears is positive and constant through Spicer Universal Joints and Propeller Shaft to the Spicer Automatic Clutch mounted between the generator and the propeller shaft. This automatic clutch completely absorbs all shocks and disconnects the drive line in case of excessive overload, and also completely disconnects the generator at speeds below 8 miles per hour eliminating shock loads when cars are being shunted.

Spicer Positive Railway Generator Drives can be quickly and economically adapted to new car designs and reconditioning jobs. Write for further details.



46 YEARS OF Spicer SERVICE

Positive GENERATOR DRIVES

Manufactured, Sold and Serviced by

SPICER MANUFACTURING • *Division of Dana Corp.*

Toledo 1, Ohio

BIDDLE

NUMBER 5 OF A SERIES

Instrument News

ONE PORTABLE TEST KIT FOR MOST ELECTRICAL RESISTANCE MEASUREMENTS

Here is how one railroad uses a Rectifier-Operated Meg Type of Megger® Insulation Tester housed in the same portable carriage with a Ducter® Low Resistance Ohmmeter and a Biddle Power Supply.

Photo courtesy Santa Fe Railway

The bar-to-bar test on the armature is being made with the Ducter using duplex hand spikes having a current and potential spike in each handle. In general bar-to-bar tests are more for the purpose of equalizing the resistances than for measuring their exact values.

The Ducter ohmmeter, which measures resistances as low as a millionth of an ohm, is invaluable for maintaining normal resistances in the series fields and armature windings of diesel-electric locomotive traction motors, switch contacts, cable joints, etc. Write for our interesting Bulletin 24-25-X or the comprehensive Ducter Manual 24J25-X.

The Rectifier-Operated Meg Type of Megger Insulation Tester is included in the same mobile unit for ready use in testing electric motive and Diesel-electric motive power equipment as well as motors, generators, transformers, etc. These instruments, available in ranges up to 2000 megohms and 1000 volts d-c, are described in Bulletin 21-46-X.

We are constantly publishing new technical bulletins on Biddle Instruments. A complete list of our latest bulletins will be mailed you on request, so that you may check it to bring your files up-to-date.

JAMES G. BIDDLE CO.
1316 Arch St., Philadelphia 7, Pa.
Please mail me

☐ Bulletin 24-25-X ☐ Manual 24J25-X
☐ Bulletin 21-46-X ☐ Check-List of Bulletins available

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*Company*_____

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JAMES G. BIDDLE CO., 1316 ARCH ST.
PHILADELPHIA 7, PA.
ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

Personal Mention

(*Continued from page* 128)

HAROLD MACKEY, master mechanic of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed master mechanic at Chicago.

R. J. CHINN has been appointed master mechanic of the Illinois Central at McComb, Miss.

H. W. GLADHILL has been appointed assistant master mechanic of the Hagerstown division of the Western Maryland at Hagerstown, Md.

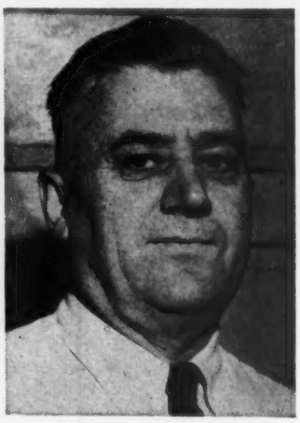
Diesel

J. S. DUCK has been appointed diesel supervisor of the Illinois Central System, with headquarters at Chicago.

Car

G. S. GLAIBER, assistant superintendent equipment of the New York Central, Lines Buffalo and East, has been appointed general car inspector of the system, with headquarters as before at New York.

WALTER C. BARRER, whose appointment as superintendent car department of the Chicago & North Western at Chicago was announced in the November issue, began as a car inspector on the C. & N. W., in 1915. After military service in World War I, he returned to the railroad in



Walter C. Barrer

1919 as a car inspector and later held various positions until 1925 when he became assistant foreman, Chicago shops. In 1942 he was appointed general foreman at the California Avenue shop; in 1944, district superintendent car maintenance, and, in 1945 assistant superintendent, car shops.

V. G. SMALL, assistant superintendent of car department for the Elgin, Joliet & Eastern, at Joliet, Ill., has been appointed superintendent of car department, with headquarters at the same point. He succeeds *W. A. Emerson*, retired after 50 years of service.

Obituary

HUGH H. DAVENPORT, general car inspector, eastern lines, Chicago, Burlington & Quincy, died November 6 in Aurora, Ill.

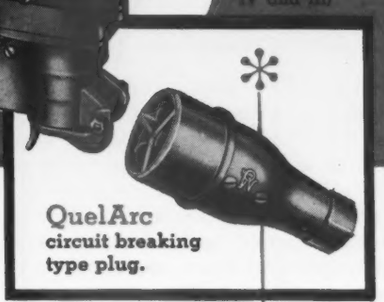
Heavy Duty Safety Switch, and Circuit Breaker

RAIN-TIGHT! DUST-TIGHT!

RAIN-TIGHT SAFETY SWITCHES with receptacle, fusible or fuseless, ratings up to 100 amps. 600 volts . . . without receptacle, up to 200 amps. 600 volts. (NEMA TYPES V, IV and III)

DUST-TIGHT AND RAIN-TIGHT CIRCUIT BREAKERS with receptacle, ratings up to 100 amps. 600 volts . . . without receptacle, up to 225 amps. 600 volts. Dust-tight types for hazardous locations, Class II, group E, F, and G. (NEMA TYPES IX, V, IV and III)

PYLETS



QuelArc circuit breaking type plug.

. . . designed for Safe, Reliable Operation and Protection of Portable and Stationary Electrical Equipment, indoors and outdoors, in Railroad Shops, Yards and Terminals.

MUCH LONGER SERVICE LIFE AND LOWER MAINTENANCE COSTS insured by heavy, rust-resisting cast metal construction and rain-tight gasket seals.

COMPLETE SAFETY FOR THE OPERATOR is provided by safety circuit grounding and the interlocking of door and plug receptacle with a quick make and break switch mechanism.

Consult your Pylet Catalog, Bulletin 1150 for complete listings.

PYLE QuelArc plugs, used with this equipment, are well known industrially, for their unique partitioned construction. Long insulating surfaces from pole to pole, and from poles to ground provide for exceptionally safe handling and long service life.

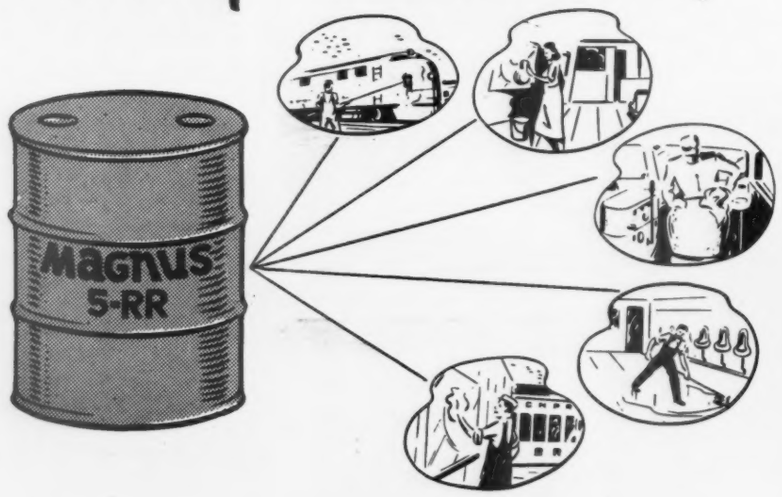
SINCE 1897

THE PYLE-NATIONAL COMPANY
1356 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

District Offices and Representatives in Principal Cities of the United States
Export Department: International Railways Supply Co., 30 Church St., New York.
Canadian Agent: The Holden Co., Ltd., Montreal.

PLUGS AND RECEPTACLES • FLOODLIGHTS • TURBO-GENERATORS • GYRALITES • CONDUIT FITTINGS • MULTI-VENT AIR DISTRIBUTION

Safe - Fast - Thorough Cleaning - at Lower Cost!



You don't have to stock a lot of special cleaning compounds for the many different cleaning operations where removal of ordinary oily, greasy dirt is involved! Here's *ONE Cleaner* that not only cleans faster and better at lower labor cost than any other cleaner available—special or ordinary—*but* disinfects and deodorizes as it cleans.

Give Magnus 5-RR a Try-Out!

This solvent-soap dissolves, emulsifies and disperses oily, greasy dirt without the use of a lot of "elbow-grease." You just use a little in water solution . . . and it works as well in cold as it does in hot water. Spray—brush—sponge it on . . . then rinse it off.

Magnus 5-RR is harmless to paint or varnish. It is very easy on the hands. And it leaves every surface on which it is used bright and clean without streaking.

Try a Drum of Magnus 5-RR for 30 Days

Use it on any oily, greasy surfaces you have to clean—diesel cabs . . . diesel exteriors . . . coach interiors . . . headliners . . . washrooms . . . toilets . . . linoleum and tile . . . station walls and woodwork . . . station floors and all other painted and varnished surfaces. *Then*, if you are not completely satisfied after 30 days of using Magnus 5-RR according to our recommendations, we will gladly cancel the invoice!

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS AND CLEANING EQUIPMENT

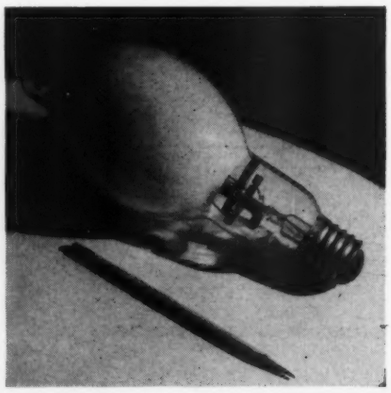
Representatives in all principal cities

NEW DEVICES

(*Continued from page 106*)

cooled Life-Line motors in N.E.M.A. frames 254 and 284, (5 and 7½ hp., 1,750 r.p.m.). They will be applied to other motors later.

◆



Fluorescent Mercury-Vapor Lamp

A high intensity mercury-vapor lamp with a fluorescent coating on the inside of the bulb, the 400-watt J-Hl fluorescent mercury-vapor lamp is available from the Westinghouse Electric Corporation.

Designed to provide a whiter light from a mercury-vapor source, the lamp has an inside coat of a phosphor that fluoresces red when activated by invisible ultraviolet light generated by the quartz arc. This tends to balance the spectrum to provide a light that is white enough for most industrial purposes.

Equipped with a BT-37 bulb with an isothermal shape that provides an even operating temperature over the entire bulb wall, the new lamp will burn in any position and can be used in existing fixtures for 400-watt mercury lamps.

Lower brightness of the J-Hl makes operation at lower mounting heights practical, which widens the field of use for mercury lamps. Increased fixture efficiency is obtained by removing the diffusing shield frequently used with the A-Hl.

Electrically similar to the 400-watt A-Hl and E-Hl types, the J-Hl will operate from H-1 ballasts.

◆

Direct Heat Rotary Dryer-Screener

Of great interest to operating railroads is the question of drying green sand. This is partially due to the high labor cost when drying sand with the old pot-bellied stoves.

For drying sand and other inorganic free flowing granular material, the Mines Equipment Co., Division of Joy Manufacturing Co., Pittsburgh 22, Pa., has intro-

Pittsburgh's Alkali and Acid-Resistant CARHIDE...

Provides better protection and longer life for covered hopper cars!

● One of the hundred covered hopper cars refinished with alkali- and acid-resisting CARHIDE in use for more than a year by the Rock Island Lines.

YOU can now give added years of service to covered hopper, refrigerator and tank cars with Pittsburgh's alkali- and acid-resisting CARHIDE.

● **This new product** of Pittsburgh's leadership in paint research now makes possible an entirely new degree of protection against the effects of cargoes which quickly destroy ordinary finishes.

● **A number** of leading railroad lines have tested this finish on several hundred cars for periods from one to three years with highly satisfactory results. Tests have demonstrated that such ladings as soda ash, sulphur, phosphates, cement, lime, common salt, alkalis, crude oil and alcohol will not affect it. Furthermore, it has shown high resistance to abrasion as well as to repeated scrubbings.

● **This new CARHIDE** dries as quickly as lacquer—you can maintain one-day finishing schedules.

● **If your line** has cars used to carry corrosive cargoes it will pay you to investigate this new alkali- and acid-resistant CARHIDE. Call on us for suggestions and advisory service.

PITTSBURGH PLATE GLASS COMPANY
Industrial Paint Division, Pittsburgh, Pa.

Factories: Milwaukee, Wis.; Newark, N. J.; Springdale, Pa.; Houston, Texas; Los Angeles, Calif.; Portland, Ore. Ditzler Color Division, Detroit, Mich. The Thresher Paint & Varnish Co., Dayton, Ohio. Forbes Finishes Div., Cleveland, Ohio. M. B. Suydam Div., Pittsburgh, Pa.

Pittsburgh Railway Finishes For Every Need

CARHIDE—for wood and metal freight cars of all types.

LAVAX SYNTHETIC ENAMELS—for locomotive and passenger cars.

STATIONHIDE—adds beauty and attractiveness to stations.

IRONHIDE—for iron and steel fixed properties.

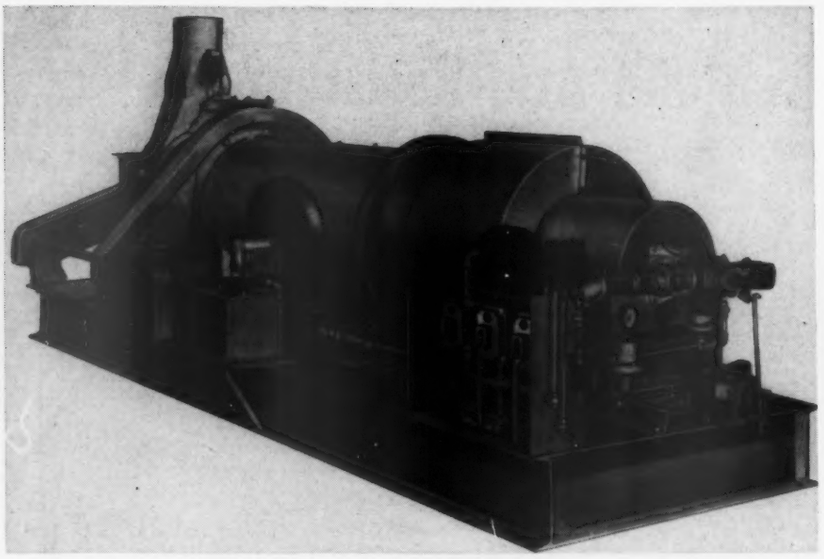
SNOLITE—white fume-proof paint for signs, crossing gates, fences and cattle guards.

PG

PITTSBURGH PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY



duced their direct heat rotary dryer screener. It screens as it dries 2 to 3 tons of sand per hr.

The high evaporating capacity of this unit makes it suited to drying sand needs for traction, sand blasting and meeting the sand-heating or demoisturizing requirements of paving mixtures. It operates on the "counter-flow" direct heat principle, that is the material is fed through dryer towards the source of heat located at discharge end.

Its frame is constructed of structural steel channel; superstructure and drum is made of steel plate. All parts are full welded and securely bolted. The motor is a 2 hp. 220 or 440 volt, 3 phase, 60 cycle unit, fully enclosed and fan cooled. The heating unit is available in a choice of oil or gas burning models.

Hydraulic Remote Control

A new line of hydraulic remote controls have been released by Sperry Products, Inc., Danbury, Conn. These devices are, according to the manufacturer, the only single tube, balanced, self-contained system operating independently without outside sources of power.

The unit consists essentially of a hand-actuated transmitter and a receiver connected by a single tube. The system is filled with hydraulic oil, and due to the oil's incompressibility, force applied to the transmitter is immediately delivered to the receiver.

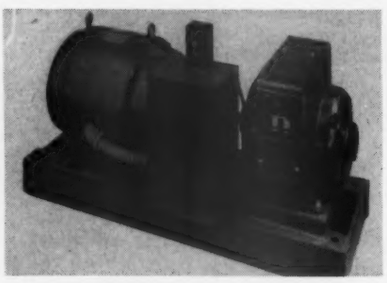
This control system makes possible precision operation of a remote mechanism, free of backlash and the sponginess of the ordinary pneumatic control.

The devices may be used for manual or automatic control of many varied pieces of apparatus in the industrial, automotive, railroad and marine industries. They have a maximum rated output of 400 in.-lb. on the pressure stroke and 125 in.-lb. on the return stroke.

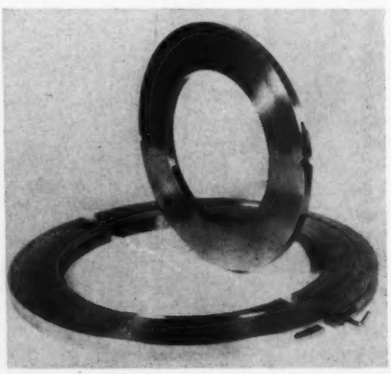
◆

High Cycle Motor Generator Set

For converting 60-cycle current to 180-cycle and 360-cycle frequencies, a new mono-coil high frequency motor generator set has been made available by Electric Machinery Manufacturing Company, Minneapolis, Minn. This machine finds its greatest use in plants using high-cycle automatic electric hand tools such as grinders and buffers. The sets are self-exciting and have built-in voltage regulation which automatically compensates for fluctuations in voltage to the load.



The compact, easily installed unit shown is rated 6 kw., 360 cycles, 3,600 r.p.m. Other ratings and speeds are available.



Split Thrust Washers

The patented "Sabeco" split washers, manufactured by the Saginaw Bearing Co., Saginaw, Mich., are designed to facilitate repair. It is not necessary to dismantle a machine to install new bearings. The split

Lewis sealtite car bolts

More than 85% of America's Class I railroads use Lewis Sealtite products. Designed to do a better job . . . to last longer . . . to meet the most exacting specifications. Specify Hot Dip Galvanized, Zinc finish for Double-Life and economy.

Lewis BOLT & NUT COMPANY
504 Malcolm Ave. S. E.
MINNEAPOLIS 14, MINNESOTA

LOOK FOR THIS STAMP OF U QUALITY

Sealtite bolts are available with Loktite Nut #2 (shown), or std. sq. and hex. nuts

washers are simply slipped over the shaft and locked with the safety key. Thus, the new split washers make possible quick, on-the-spot repair and more economical operation. These washers are suitable for heavy construction machinery; plant machinery; materials moving equipment; oil field equipment; power house and other large electrical installations and large pumping stations or any job using thrust washers.

The replacement split washers are made of a special bronze which is the combination of a high percentage of pure copper, pure tin and pure lead with a maximum of 0.2 per cent impurities.

The manufacturer can supply these split washers in any practicable size, made-to-order to various specification.

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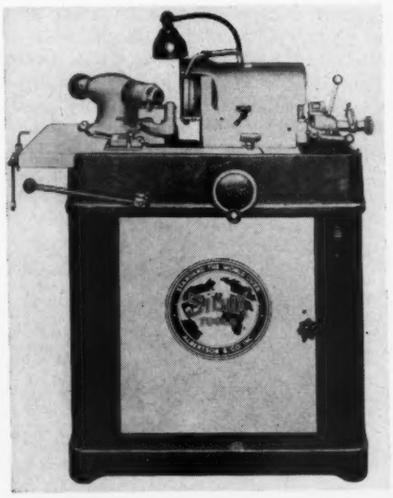


Service Equipment For Diesel Locomotives

A line of machines and special tools for use in reconditioning work on diesel locomotive engines is now being introduced in railroad shops by Albertson & Company, Inc., Sioux City, Iowa. The principal tool is a valve grinding machine which will grind valves up to 6 in. diameter and is arranged for mounting either on a work bench or service cabinet with easy-opening hinge door and ample shelf space for auxiliary tools and equipment such as the heavy-duty valve seat grinding set, grinding wheel dresser, etc., made by this company.

The Sioux valve grinding machine is designed for built-in wet grinding to minimize wheel dressing, heat and distortion and produce an exceptionally fine finish. The machine, illustrated, has a capacity to grind valves with ¼ in. to 1¼ in. stems up to 18 in. long, 6 in. diameter and with angles varying from 15 deg. to 90 deg. It is equipped with a quick acting roller chuck, automatic chuck stop and micrometer graduated feed. The anti-friction chuck slide is mounted on roller bearings. An 8 in. grinding wheel is provided for grinding the valve face and a 7 in. cup wheel for grinding the valve end.

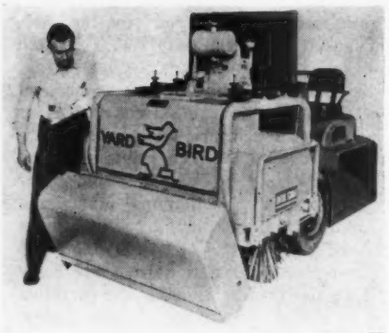
The machine is driven by a 1-hp. 230-volt

60-cycle single-phase motor. It is equipped with a rigid grinding head having cage-mounted precision ball bearings permanently lubricated. A removable coolant tank permits easy cleaning and has a capacity of 4 gal. A pump mounted in the tank is self-priming. The machine is 32 in. long by 19 in. wide. Standard equipment includes a wheel dressing attachment, micrometer valve end and rocker arm grinding attachments. When desired the machine may be supplied with a lever-operated chuck for more powerful grip, easier and faster operation.

Sweeper Attachment For Fork Lift Trucks

Yard Bird is the name given a new, low-cost powered sweeper, recently introduced by Little Giant Products, Inc., Peoria, Ill., which is designed as an attachment to fit any fork lift truck of 1,500 lb. capacity, and up. The sweeper, operated by the lift truck operator, can clean indoors and out as rapidly as 80,000 square feet per hour with the truck traveling 5 m.p.h.

The Yard Bird has its own self-contained



spray system for dust control. A 6.8 hp. gasoline engine turns at 2,400 r.p.m., but an integral clutch reduction unit and sprockets step down brush revolutions to 164 r.p.m. The sweeper is of the pick-up type, with the brush whisking dirt and refuse into a full-width floating dust pan.

The sweeper is designed for quick attachment to the fork lift of the truck during cleanup hours in 2½ to 3 min. Connection is by four eye-bolts and clamping bars on each side just above the pipe frame. Securing is by wing nuts, with no tools required. The 30-gal. water tank for the sprinkler system is built in as an integral part of the Yard Bird hood.

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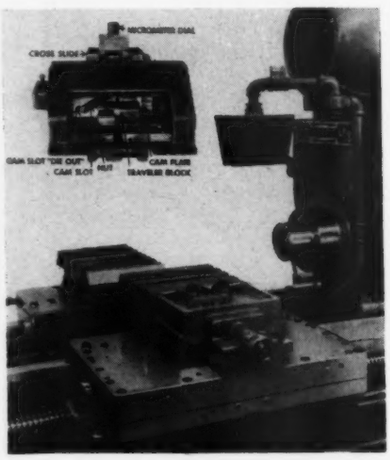
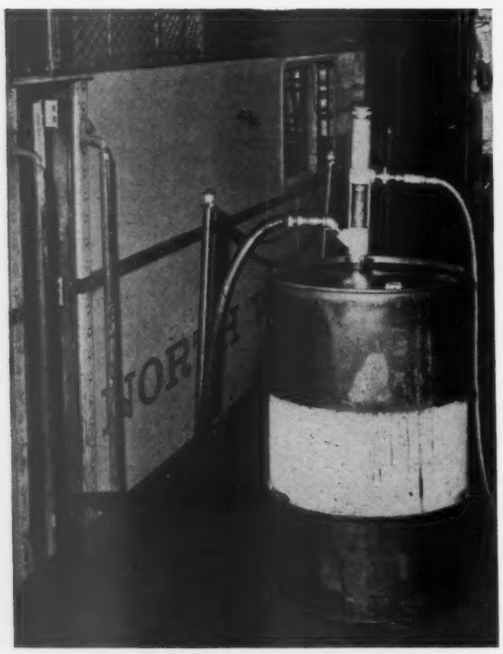


Cam-Operated Cross Slide

A new cam-operated rear cross slide on the Duomatic lathe offers greatly increased rigidity for forming, grooving, necking and similar operations, according to the manufacturer, The Lodge & Shipley Company, Cincinnati, Ohio.

Production increases are claimed for the new arrangement which replaces the former rack and pinion slide. Designed particularly for the operations noted and not for turning, the new slide is heavier and effectively handles even the most difficult forming cuts. When turning with the rear slide is desired, a rack and pinion cross slide can be furnished at additional cost.

The cam, which feeds the slide into the workpiece, has been so constructed to positively move the slide inward at a constant rate. When the tools reach the end of the stroke, the inward feed "dies out" in the cam slot. Thus, the cam itself determines diametral accuracy with absolute uniformity.



WILKINSON

High Speed Diesel Lube Oil Transfer Pump

REDUCE your Diesel lube oil handling time by more than 41% and eliminate oil spillage. Use the WILKINSON light-weight air-operated transfer pump. Only weighs 15 lbs. and no air enters barrel.

You can pump a 55-gal. barrel S.A.E. #40 lube oil in 5 minutes with only one man.

Can furnish ready-to-use,—package consisting of WILKINSON Transfer Pump, 35 feet of ¾" oil hose, and automatic shut-off valve.

HUDSON 3 5271
WILKINSON EQUIPMENT & SUPPLY CORP.
6958 SOUTH WENTWORTH AVENUE
CHICAGO 21 ILLINOIS

AIRCO ACCURACY...

PRECISION ... OPERATING ECONOMY

designed into the all new

AIRCO NO. 50 TRAVOGRAPH

GAS CUTTING MACHINE

Airco's NEW No. 50 Travograph is a rugged, all-welded gas cutting machine. Its massive, long-lived design is engineered to give fingertip sensitivity to all production operations. Used as a basic tool for multi-torch shape cutting, squaring or beveling, its outstanding accuracy slashes reject loss and working costs to a minimum.

Today's most modern production tool, the rugged new Airco No. 50 Travograph precision-cuts steel—light plates, heavy slabs, billets, forgings—to close tolerances. Here are the reasons for its remarkable exactness . . . the "why" it guarantees faithful reproduction.

1. All-welded construction provides a combination of ruggedness, resistance to vibration, and precision operation.
2. Rigidity built into the torch-bearing pantograph arms enables the torch bar to support a uniform load of *500 lbs!*
3. Perfectly-balanced when properly set on 16′ rails.
4. Ball bearings in the hinge joints make it extremely smooth operating.

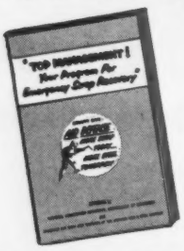
For greatest operating flexibility, the new No. 50 Travograph can be equipped with three distinctly different tracing devices—manual, magnetic, or the full-automatic "Electronic Bloodhound". The "Electronic Bloodhound" needs only an outline drawing or silhouette to cut the most intricate shapes smoothly, sharply, quickly . . . and with extreme accuracy.

If your production line requires quantity flame shaping operations . . . and if close precision cutting would lower your finish-machining costs . . . it will pay you to investigate Airco's new No. 50 Travograph. For complete information write your nearest Airco office for the new catalog just coming off the press.

AIRCO **AIR REDUCTION**

AIR REDUCTION SALES COMPANY • AIR REDUCTION MAGNOLIA COMPANY
AIR REDUCTION PACIFIC COMPANY
REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL
Divisions of Air Reduction Company, Incorporated
Offices in Principal Cities

How Can America Produce All the Steel It Needs ... for Military ... and Civilian Purposes?



FREE BOOKLET Tells How to Conduct Scrap Salvage Program in *Your* Business.

Address Advertising Council, 25 W. 45th St., New York 19, N. Y.

One way is to feed more pig iron into the furnaces. But . . .

That will require *more* supplies of ore, limestone, coal, etc.*—to say nothing of more new ore boats and rail cars to transport the additional supplies.

A better way—the *only* practical way—is to use the *dormant* iron and steel scrap lying around in the form of old machines, equipment, tools and metal structures.

Your business *must* have available scrap—in *some* form. That scrap is *needed* to keep the furnaces going in the steel mills . . . to keep our fighting forces and our allies well armed . . . to sustain our civilian life at home.

Think how many ways *you* use iron and steel. Think what would happen if it became extremely scarce. Put your iron and steel scrap to good use—now—by selling it to your local scrap dealer.

Don't delay—the emergency is becoming more severe every day.

*For every ton of scrap fed into the furnaces, we save approximately 2 tons of iron ore, 1 ton of coal, nearly ½ ton of limestone and many other critical materials. Also, scrap helps make steel faster, shortens the refining process.

NON-FERROUS SCRAP IS NEEDED, TOO!

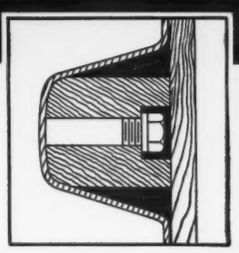
This advertisement is a contribution, in the national interest, by

RAILWAY MECHANICAL AND ELECTRICAL ENGINEER

SOLVED BY NELWELD

Cost-Saving TECHNIQUE FOR CAR BUILDERS

Split-second welding of studs to car ends with the Nelweld method. Portability of the lightweight Nelweld gun permits using it in any job location or working position.



Neater, permanently WATERTIGHT car ends result from Nelwelding studs to secure furring strips. Studs may be located by center punch marks or simple templates.

. . . CUT COSTS WITH NELWELD

Cost-saving techniques in car building are provided by the Nelweld method. Workmen using portable Nelweld guns, weld studs in position in a fraction of the time required for other methods.

Nelweld speeds up production and lowers costs by (1) eliminating drilling or punching, tapping, or hand welding; and (2) reducing manpower and materials handling time on heavy car sections during fabrication. Take the tool to the job and weld each Nelson granular flux-filled stud in a fraction of a second.

Smoother exterior surfaces, stronger members, and lower maintenance costs result from the elimination of punched or drilled holes when the Nelweld method is used.

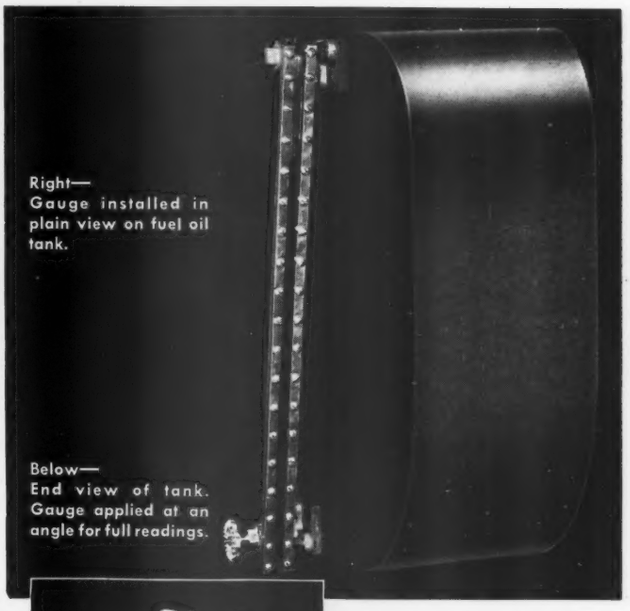
Full information and Nelweld Engineering Service are available to show you how these advantages can bring cost-saving results to your fastening operations. Contact your nearest Nelson representative or Dept. R-1, Lorain, Ohio.

Fasten it Better...at Less Cost, with NELWELD

NELSON STUD WELDING

DIVISION OF GREGORY INDUSTRIES, INC., LORAIN, OHIO

Get Full Readings on Diesel Fuel Tanks with this New MAGNUS GAUGE



Right—
Gauge installed in plain view on fuel oil tank.

Below—
End view of tank. Gauge applied at an angle for full readings.

A top-to-bottom gauge, flexible — mountable at any angle, the new Magnus diesel fuel tank gauge gives accurate full readings at all times. With a rigid brass body, the Magnus gauge is substantially built to stay on the job longer . . . not to be disturbed by vibration.

It's easily installed—simply by welding top and bottom plates to tank and drilling two holes. The reflex glass gives you accurate readings at a glance. For quick clean-out, just unscrew top and bottom plugs. Automatic shut-off valve prevents fuel loss in case of breakage.

Write for further information.

MAGNUS BRASS MFG. CO.

Subsidiary of National Lead Co.

525 Reading Road **Cincinnati 2, Ohio**

The Proof of a Product is its Endorsement

Experience has proved that Ex-Cell-O hardened and ground steel pins and bushings last longer. That's why so many American railroads have standardized on Ex-Cell-O products. They have found that by resisting road shock and vibration, Ex-Cell-O pins and bushings reduce wear on costly foundation parts; cut out-of-service time to a minimum; frequently give from four to six times longer service than other pins and bushings. Standard styles and sizes for steam, Diesel and passenger car equipment are listed in Ex-Cell-O Bulletin 32381. A free copy is yours on request.

XLO

HARDENED AND PRECISION GROUND STEEL PINS AND BUSHINGS

51-16

Railroad Division **EX-CELL-O CORPORATION** Detroit 32, Michigan

---

STEEL

CHICAGO **PRESS BRAKES**

Readily adapted for a wide variety of bending, forming, drawing, notching, blanking, punching, etc.

Complete Line of DIES for All Makes and Sizes of PRESS BRAKES

DREIS & KRUMP MANUFACTURING COMPANY
CHICAGO
7414 S. Loomis Blvd., Chicago 36, Ill.

SAVE LABOR! STOP ACCIDENTS!

All-KLEER
DIESEL ENGINE STAND

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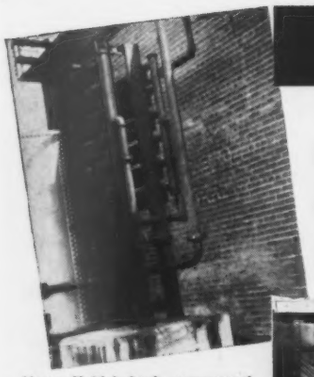

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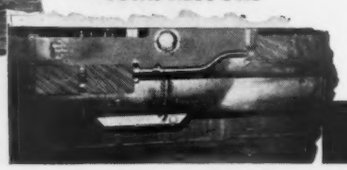

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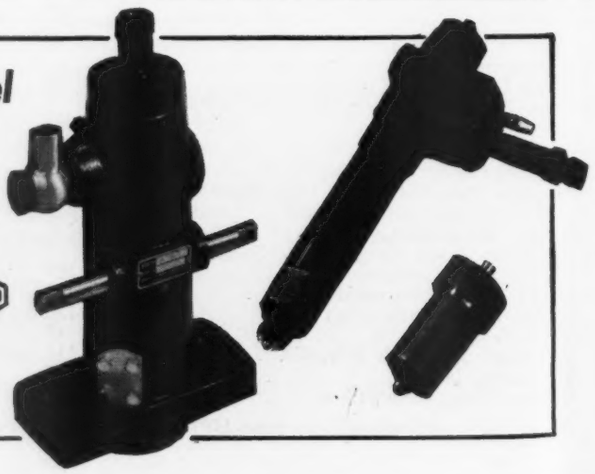

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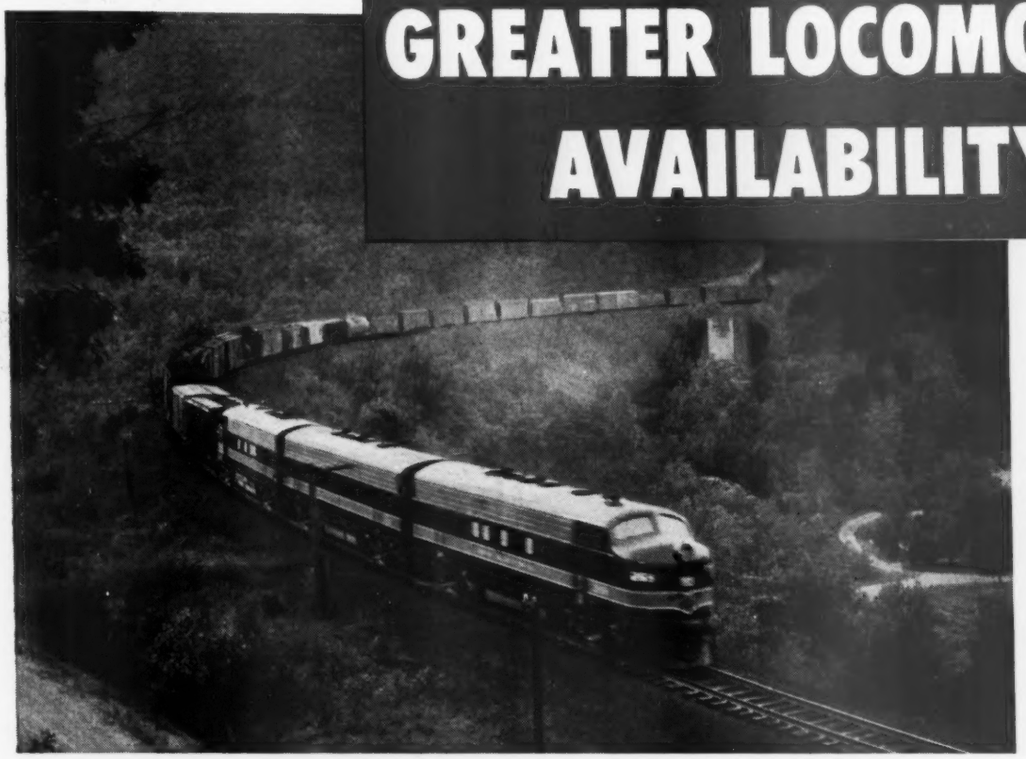

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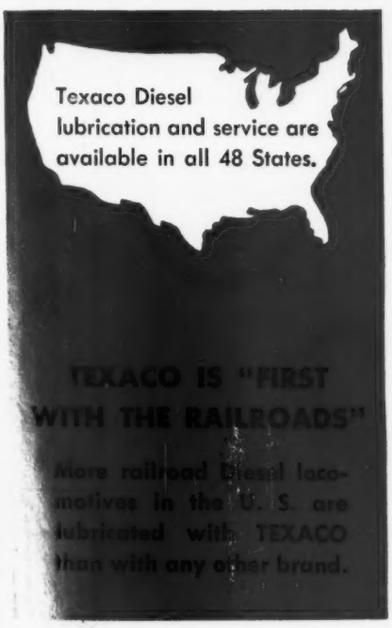
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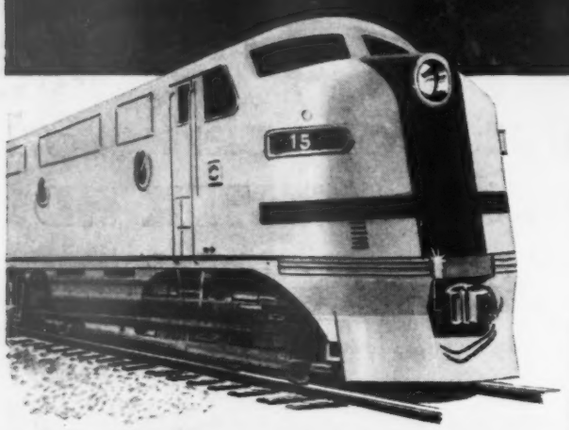

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